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CHARACTERIZATION OF THE SAND
ON
SELECTED MUNITION TEST SITES
AT
EGLIN AIR FORCE BASE, FLORIDA

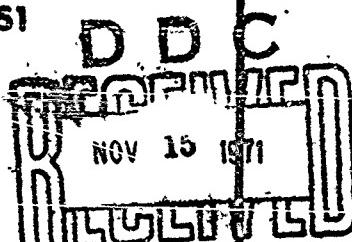
DAMAGE MECHANISM BRANCH
TECHNOLOGY DIVISION

TECHNICAL REPORT AFATL-TR-71-51

APRIL 1971

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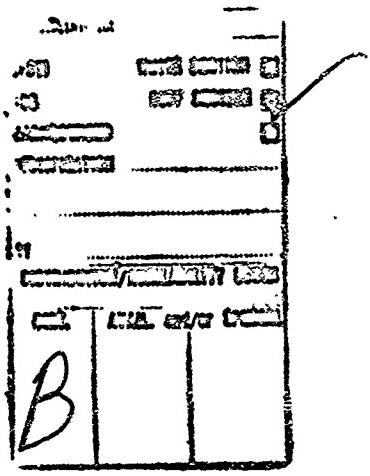
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32542.



AIR FORCE ARMAMENT LABORATORY

AIR FORCE SYSTEMS COMMAND • UNITED STATES AIR FORCE

EGLIN AIR FORCE BASE, FLORIDA



**Characterization of the Sand
on
Selected Munition Test Sites
at
Eglin Air Force Base, Florida**

James C. Richardson

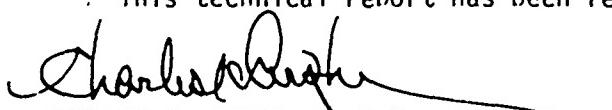
*Details of illustrations in
this document may be better
studied on microfiche*

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FOREWORD

This report documents test activities performed under the auspices of the Degradation Effects Program (DEP) between June 1968 and May 1969. DEP consists of three working groups: Test and Data Acquisition (TDAWG), Methodology and Evaluation (MEWG), and Environmental Characterization (ECWG). Fuze function data obtained by TDAWG may be found in ADTC-TP-70-198 and PGOWQ-3 data to be published. Acknowledgement is extended to Mr J. Brown of the U. S. Army Engineers Waterways Experiment Station (WFS) for his training and data gathering techniques and equipment usage, and to Mr R. F. Brandt and personnel of Range 22, all of DLRD, Eglin Air Force Base, Florida.

This technical report has been reviewed and is approved.



CHARLES K. ARPKE, Lt Colonel, USAF
Chief, Technology Division

ABSTRACT

Test data was obtained by Environmental Characterization Working Group from two sand test sites to determine how selected environmental factors affect fuze functioning. The sand is described in terms of density, percentage moisture, and penetrometer readings, and each of these was evaluated to determine its variability. Regression analysis tests were performed to determine if a relationship existed between the variables. The variables were first paired by test site and were then combined to learn if one of the variables could be predicted by knowing another. Linear correlation of the variables was also evaluated. The data is based on a controlled environment and the results should not be applied to other environments.

Distribution limited to U. S. Government agencies only; this report documents environmental conditions under which experimental and/or conventional munitions were tested; distribution limitation applied April 1971. Other requests for this document must be referred to Air Force Armament Laboratory (DLRD), Eglin Air Force Base, Florida 32542.

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SECTION I

DESCRIPTION OF TEST RANGES

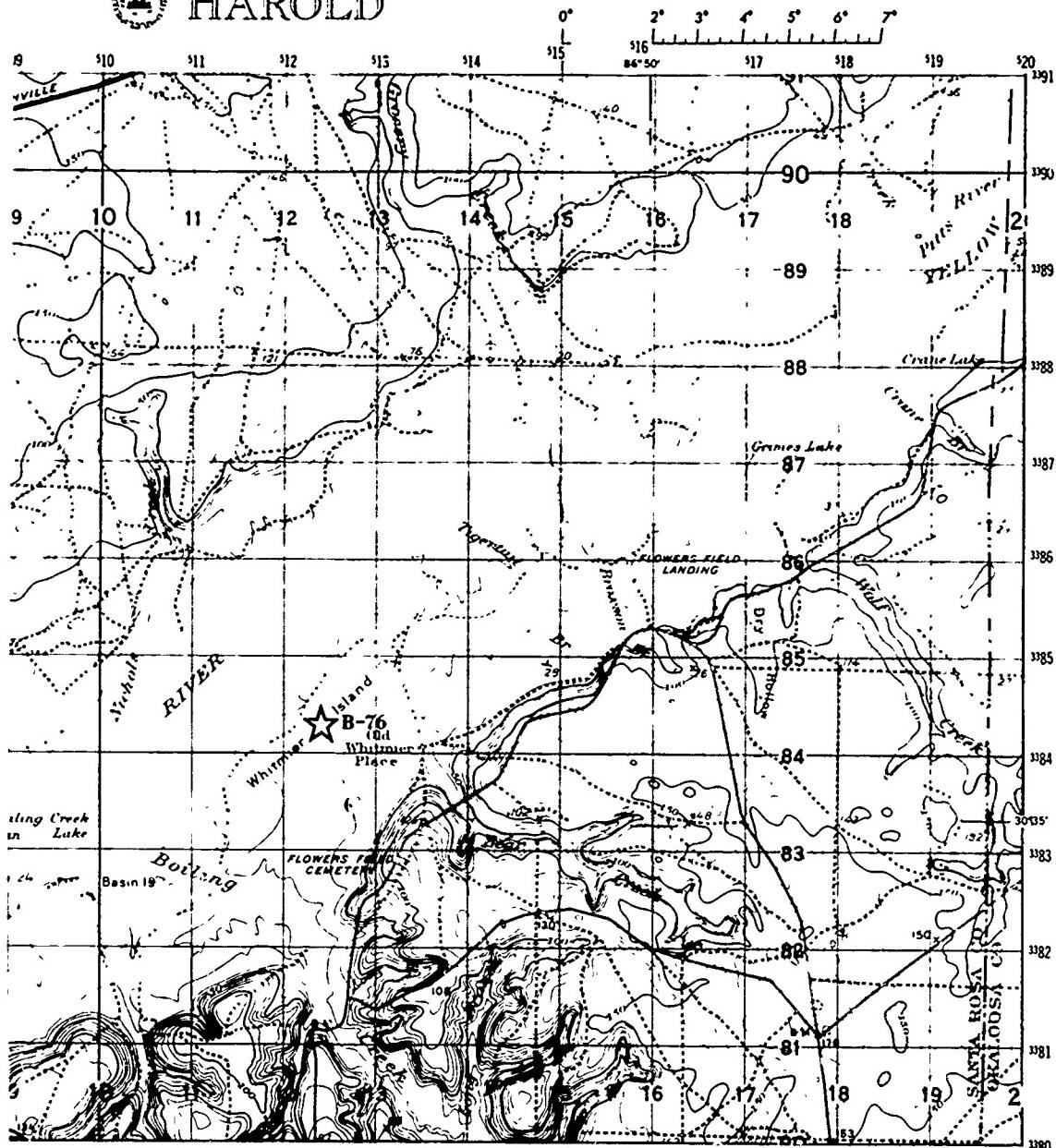
Investigations into the effects of a sand environment on munitions were conducted on Test Area (TA) B-76 and TA C-72 on the Eglin Air Force Base Reservation. TA B-76 was the site for static arena tests and for testing small conventional and/or developmental, munition items that were delivered by a pneumatic air gun (avalauncher). TA C-72 was the locale for testing munition items used in dynamic, or air-delivered, tests.

TA B-76 is in the northwest section of the Eglin Reservation at latitude 30°35' north and longitude 86°52' west, lying in the Yellow River basin and bounded by Bear Creek and Boiling Creek. The test site elevation is 20.2 feet (Figures 1 and 2). The soil was brought in from a nearby sand pit, and the results of the soil analysis are found in Figures 3, 4, and 5.

TA C-72 is located in the northeast portion of the Eglin Reservation at latitude 30°38' north and longitude 86°19' west, and at a recorded elevation of 199 feet. The test site is located on the top of a hill and has a gentle downward slope to the northeast (Figures 6 and 7). Soil for these tests was insitu (its natural and original position). Analyses of these samples and their findings are presented in Table I and Figure 8.



HAROLD



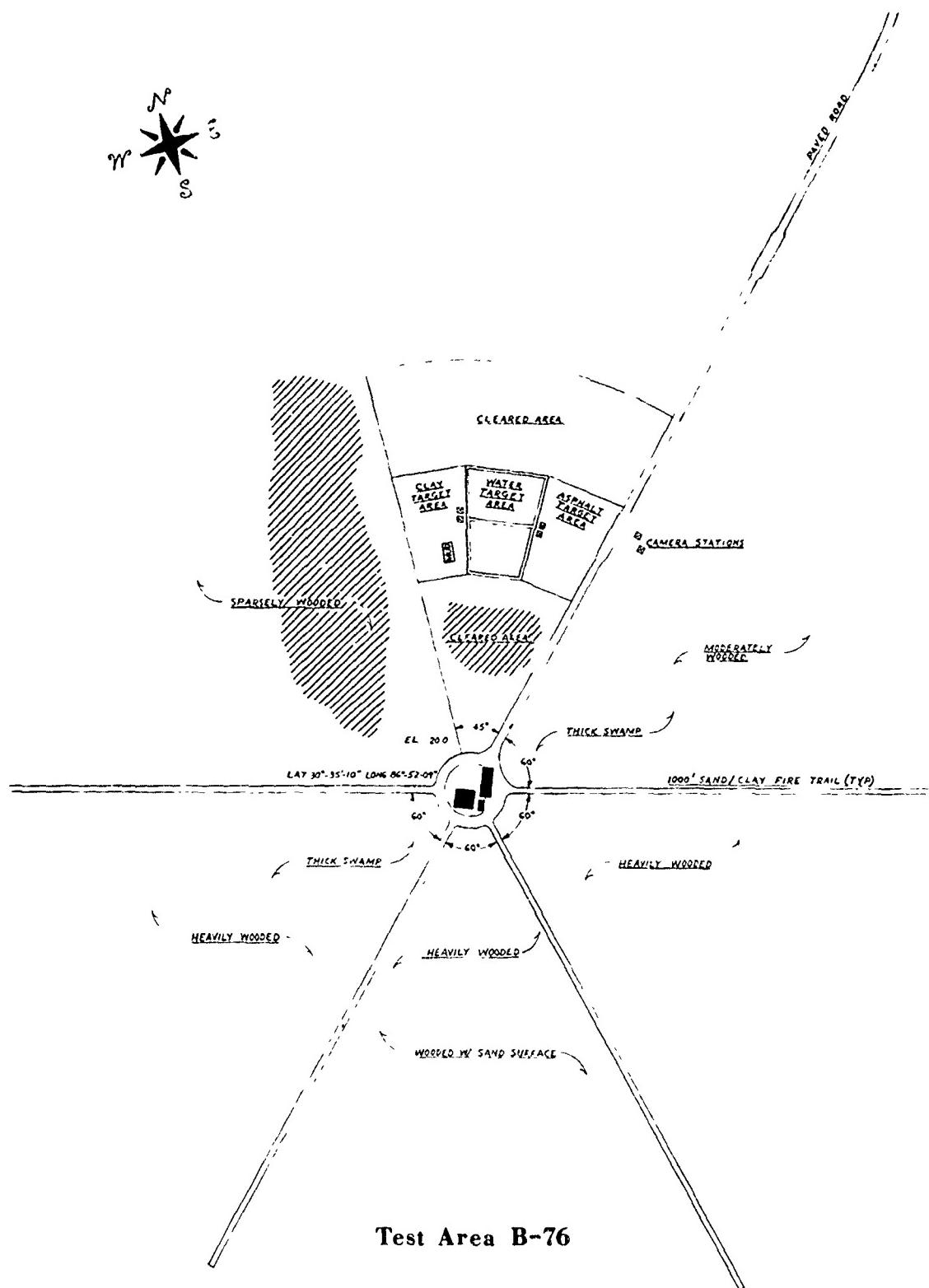


Figure 2. Sketch of Test Area B-76

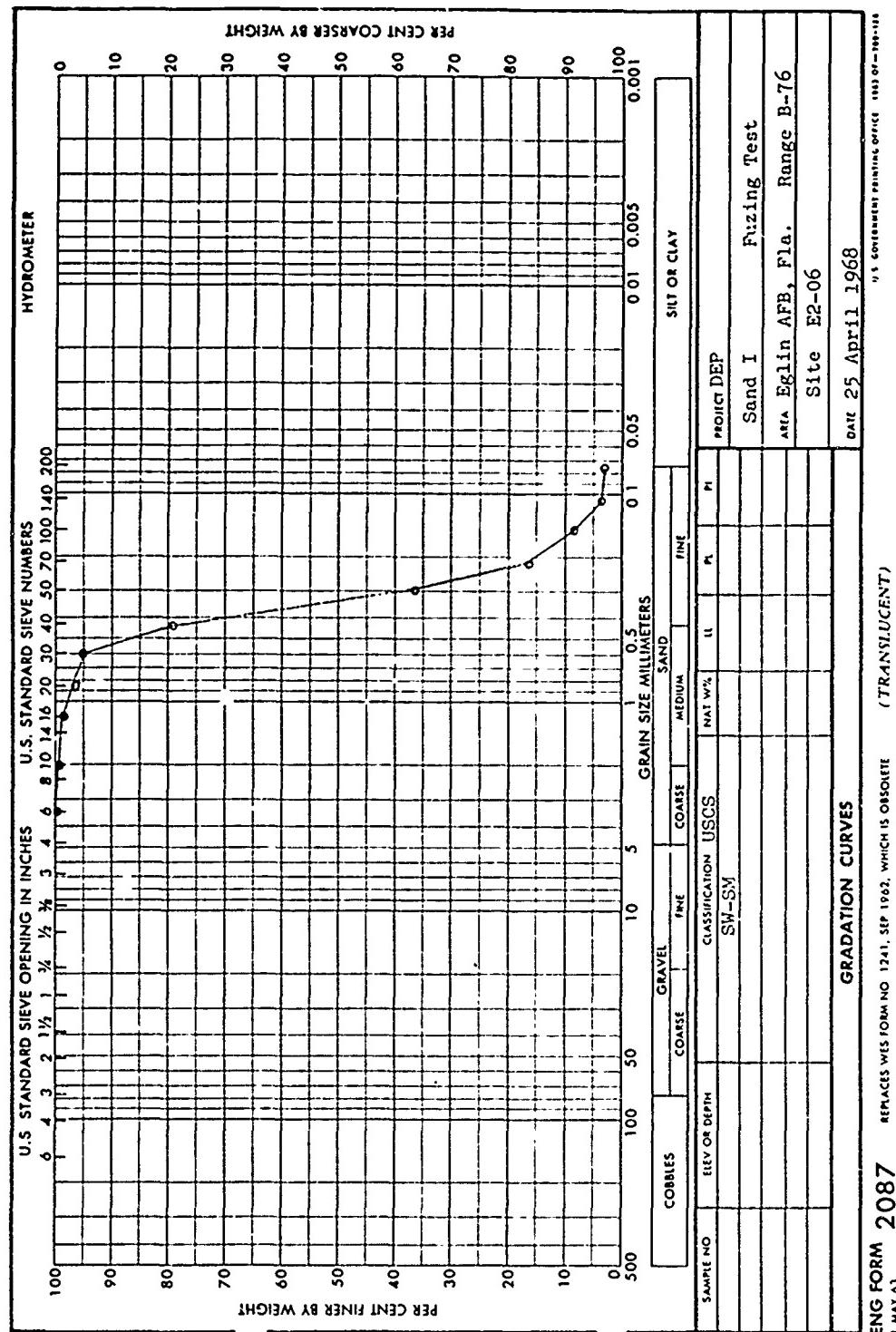


Figure 3. Analysis of Soil Samples from Fuzing Test at Test Area B-76

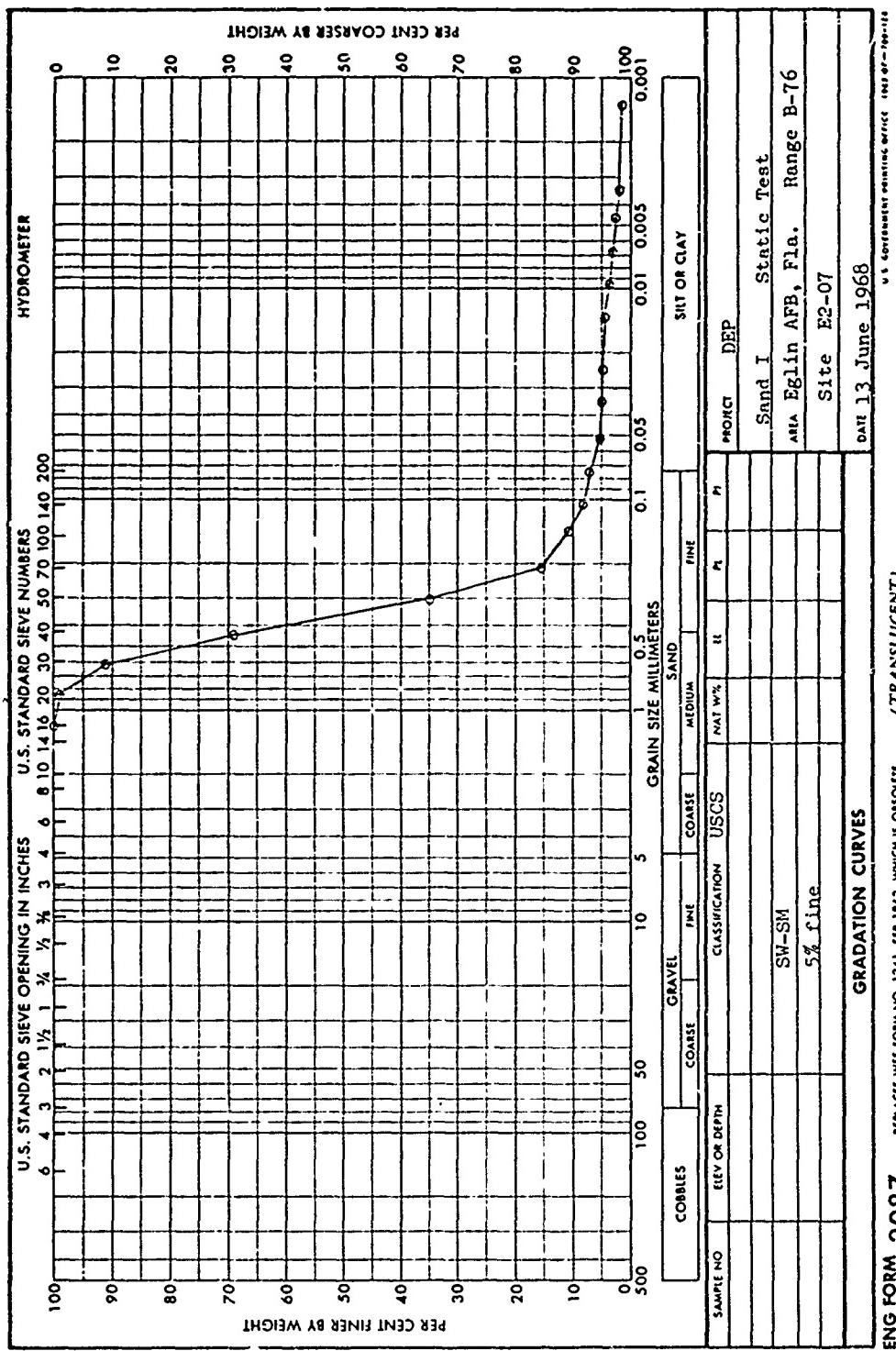


Figure 4. Analysis of Soil Samples from Static Test at Test Area B-76

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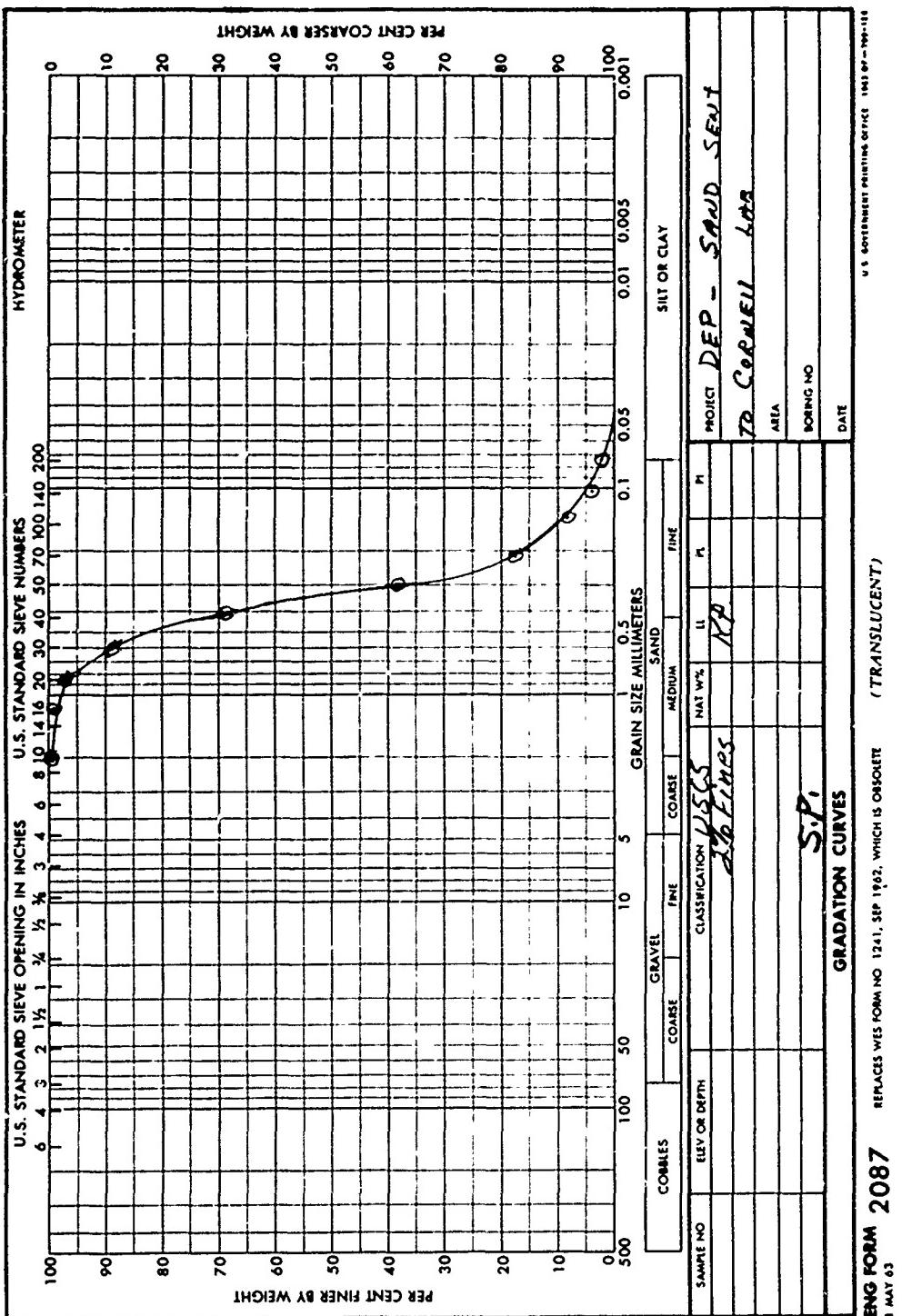


Figure 5. Analysis of samples from test Area B-76 Sand

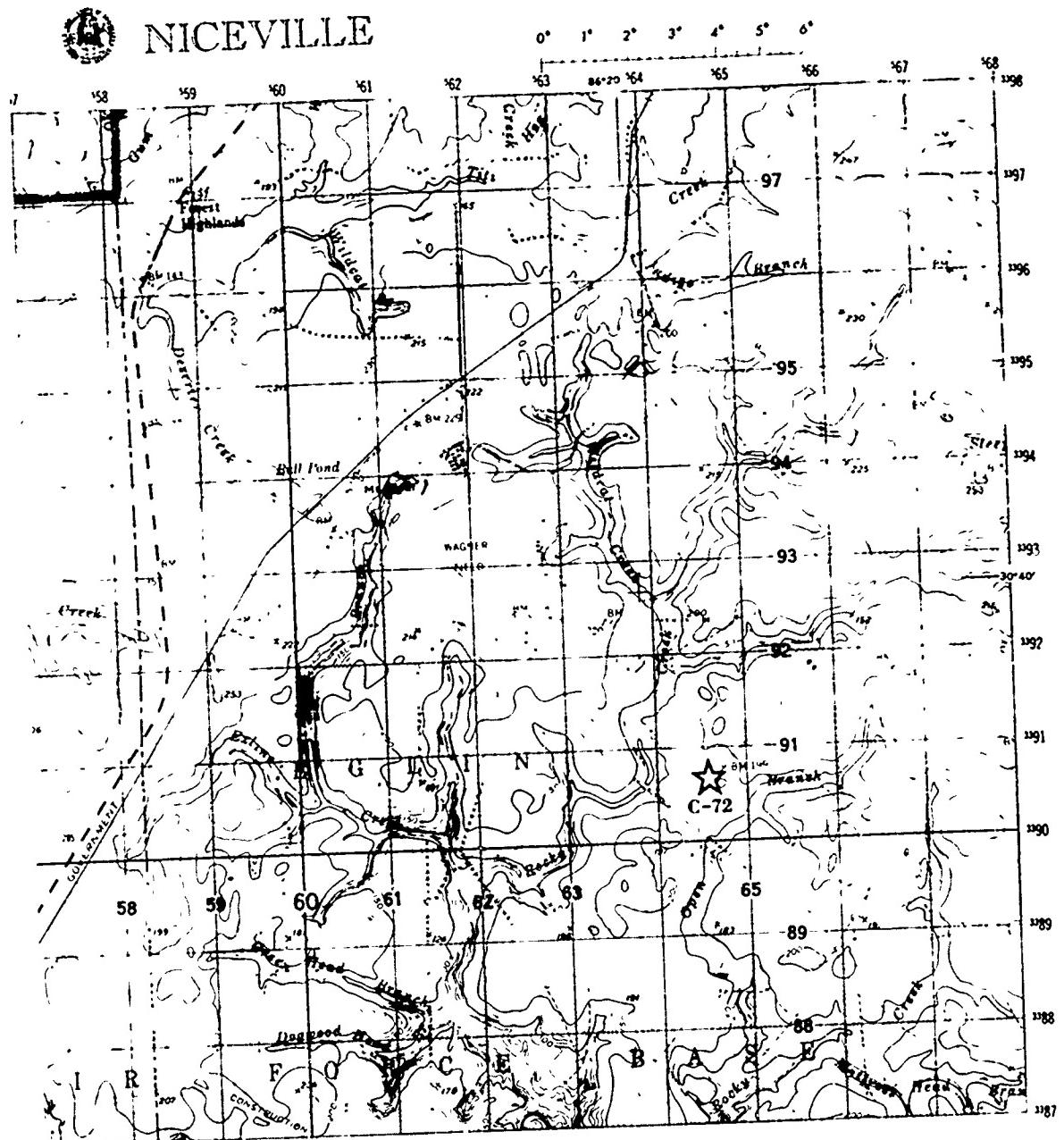
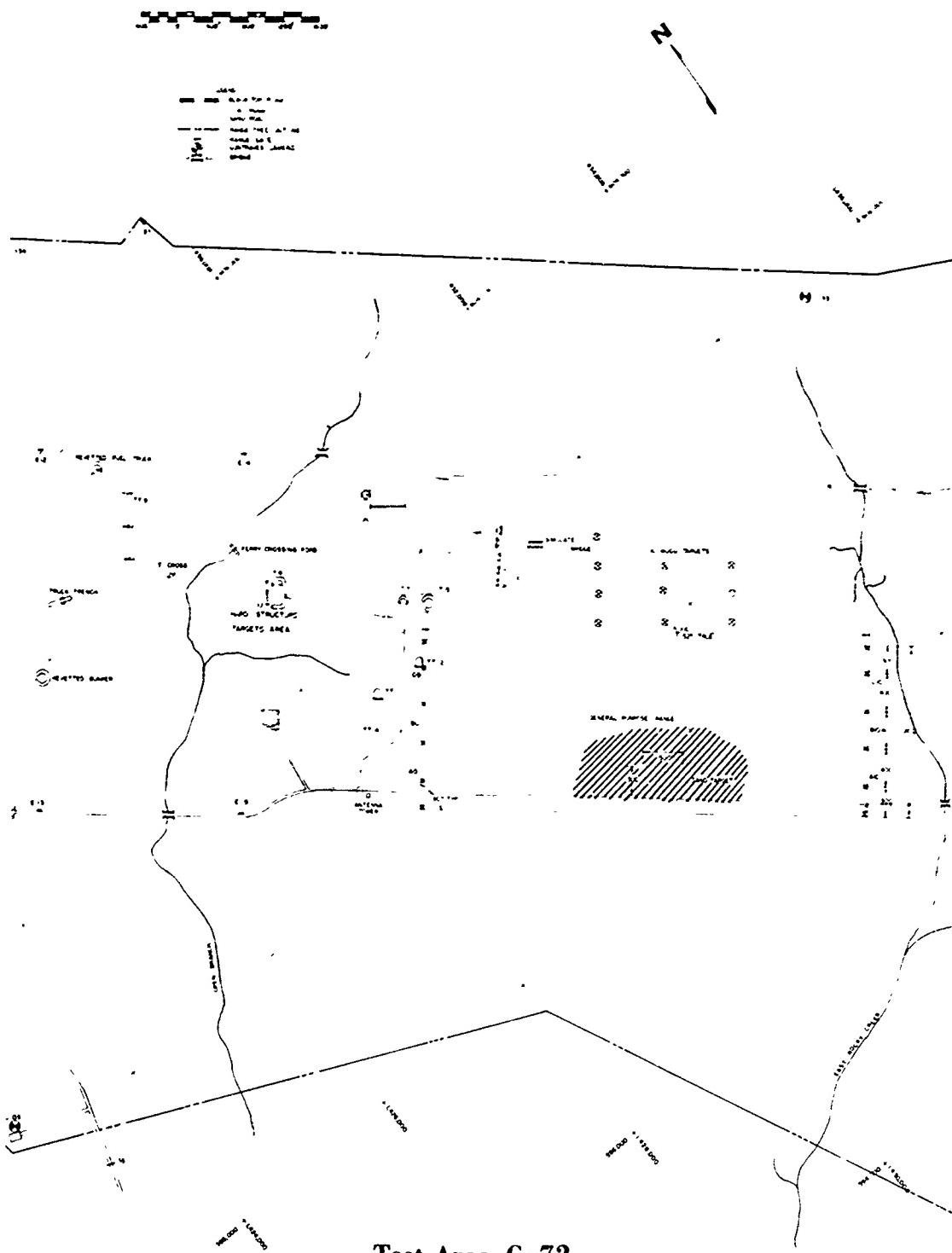


Figure 6. Map Showing Location of Test Area C-72



Test Area C-72

TABLE I. SOIL PROPERTIES OF SAND TEST SITE E8-01, TEST AREA C-72

USDA ^a Percent by weight				USCS ^b Percent by weight				Grain Size		Amount Retained on U. S. Sieve of Size				
Gravel	Sand	Silt	Clay	Type	Gravel	Fines	Type	4	10	30	50	100	200	Passing 200
-	94	4	2	S	-	7	SP-SM	-	-	2	42	44	5	7
Depth of Sample, Inches														
0 - 3		Clay		Vermiculite		Kaolinite		Quartz		Plagioclase Feldspar		Hematite		
		Minor		Very Minor		Abundant		Minor		Very Minor				
				Grain Shape										
		Tabular		Irregular		Elongated				Shear-Graph Data ^c , ϕ_v				
		(Percent retained on sieve)												
50		1		98		1				22				
100		Trace		99		1								

^a USDA - U. S. Department of Agriculture Textural System^b USCS - Unified Soil Classification System^c ϕ = angle of internal friction in degrees; subscript v denotes sheargraph measurement with vanned foot.

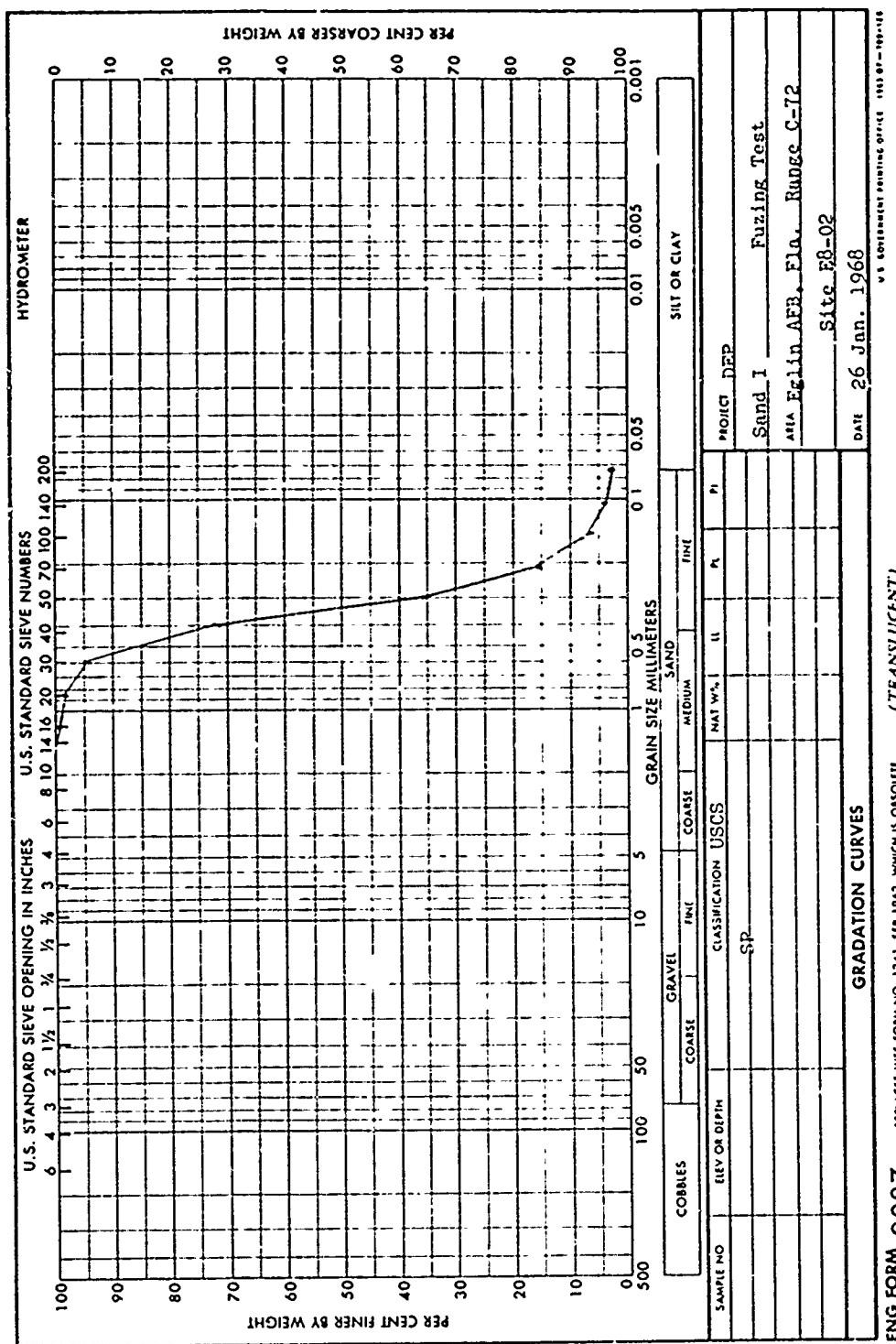


Figure 8. Analysis of Soil Samples from Fuzing Test at Test Area C-72

SECTION II

SOIL PREPARATION

Prior to testing, Sand I was described as loosely packed and having a low moisture content. Upon test implementation, Sand I characteristics data were modified to reflect a low moisture content and constant density. Penetrometer readings were taken as follows: surface, less than four; at a depth of 7.5 cm (3 inches), about 15; and at 30 cm (12 inches), not greater than 100 on the cone index gauge. To achieve these conditions, a soil stabilizer churned the sand to a depth of 30 cm. This process fluffed the soil for the penetrometer readings and aided in drying. Figures 9 and 10 show a field that has been prepared for testing.

Two observations were noted after the field had undergone preparation. The soil would crust rapidly to a depth in excess of one inch when high winds followed a rain. The top layers of soil would also crust when exposed to the sun for long periods of time. High penetrometer readings at surface reflect the degree of this crusting action. Figure 11 depicts crusting action as noted by the different shades of the soil. The top layer, which has dried and crusted, appears light in color, whereas the lower layers are quite moist and appear darker.

If a munition item landed in the tracks of the soil stabilizer, fuze function was not accepted as a valid data point.



Figure 9. Prepared Test Site C-72

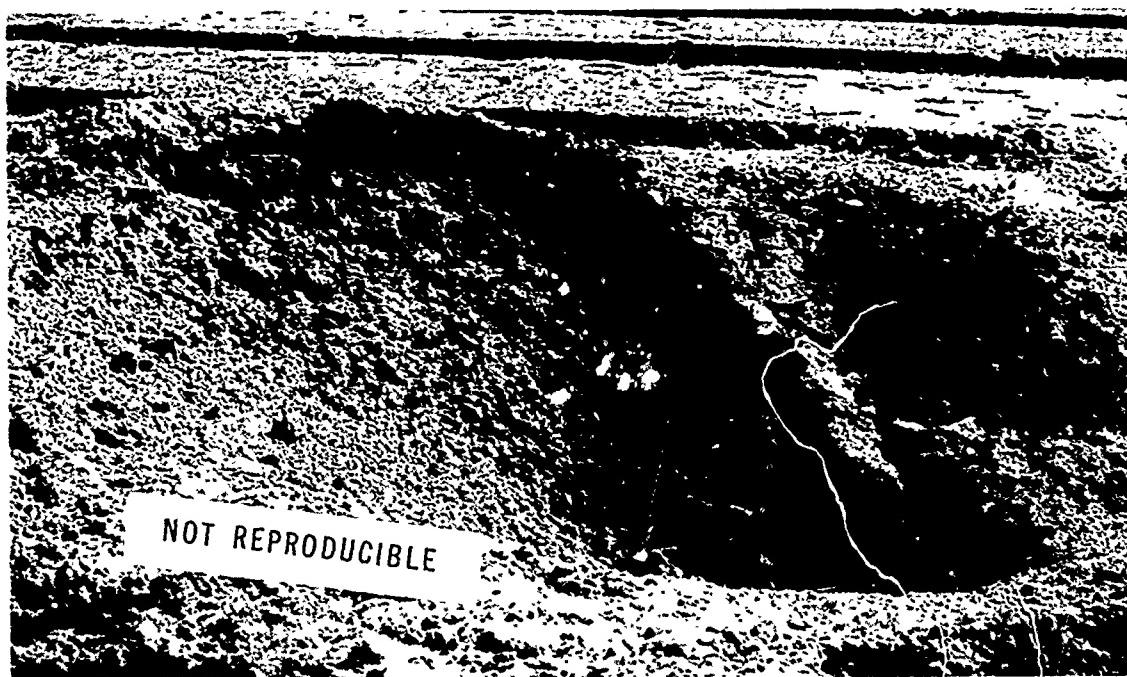


Figure 10. Crater at Test Site C-72



Figure 11. Procedure for Taking Soil Samples

SECTION III

EQUIPMENT AND METHOD

The cone penetrometer consists of a pressure ring; a gauge, which measured the cone index reading from zero to 100; two 50.5 cm metal rods that are notched at increments from 2.5 to 15 cm (1 to 6 inches), at 22.5 cm (9 inches), and at 30 cm (12 inches); and a cone, which has a 3.22 sq cm (0.5 square inch) surface. With the 3.22 sq cm cone, index readings may be read directly into pounds per square inch, on a one-to-one correlation.

As the penetrometer was pushed into the ground with constant pressure, cone index readings were recorded as shown in Figure 12. Care was taken to set the scale at zero before each probe. Penetrometer data may be found in the Appendix.

Adjacent to where the penetrometer readings were taken, a soil sample was then extracted by means of a volume cylinder to determine the moisture content and density. The soil sample came from the 5.0 to 10.0 cm depth band as shown in Figure 11. It was then put into a can, sealed, and later weighed. After drying for 24 hours under controlled conditions, its dry weight was recorded. Moisture content and wet and dry densities were then calculated and are presented in Table II.

$$\text{Wet Density} = 0.24 \text{ (Wet soil weight in grams)}$$

$$\text{Dry Density} = 0.24 \text{ (Dry soil weight in grams)}$$

$$\text{Moisture Content} = \frac{\text{Water weight in grams}}{\text{Dry soil weight in grams}}$$

Where 0.24 is a constant for the volume cylinder.



Figure 12. Procedure for Taking Penetrometer Readings

TABLE II. SAND MOISTURE-DENSITY DATA

Test Area	Station No.	Date	Moisture Content %	Wet Density		Dry Density	
				g/cm ³	lb/ft ³	g/cm ³	lb/ft ³
B-76	7	1 May 68	7.7	1.5169	94.7	1.4112	88.1
	13		6.2	1.4961	93.4	1.4064	87.8
	28	6 May 68	4.6	1.3759	85.9	1.3199	82.4
	33		4.7	1.4128	88.2	1.3487	84.2
	41	7 May 68	3.7	1.3888	86.7	1.339	83.6
	49		5.0	1.4849	92.7	1.4128	88.2
	50		4.4	1.4416	90.0	1.3791	86.1
	59		4.4	1.3791	86.1	1.3183	82.3
	77	8 May 68	3.3	1.4480	90.4	1.4016	87.5
	80		3.7	1.3952	87.1	1.3439	83.9
	85		3.7	1.3103	81.8	1.2622	78.8
	88		1.4	1.4064	87.8	1.3519	84.4
	93	9 May 68	3.2	1.3808	86.2	1.3375	83.5
	120		3.8	1.4288	89.2	1.3759	85.9
	103		2.4	1.3359	83.4	1.2975	81.0
	99		2.9	1.4528	90.7	1.4032	87.6
	121	10 May 68	3.5	1.4705	91.8	1.4208	88.7
	132		3.3	1.4224	88.8	1.3775	86.0
	133	13 May 68	2.6	1.4817	92.5	1.4448	90.2
	139		2.0	1.4560	90.9	1.4288	89.2
	153		1.7	1.3695	85.5	1.3455	84.0
C-72	239	27 June 68	5.2	1.2142	75.8	1.1549	72.1
	249		4.8	1.2798	79.9	1.2222	76.3
	236		4.2	1.2862	80.3	1.2234	77.0
	199		3.8	1.3247	82.7	1.2750	79.6
	253		4.2	1.3295	83.0	1.2766	79.7
B-76	257	29 June 68	3.3	1.4528	90.7	1.4080	87.9
	267		2.5	1.4208	88.7	1.3856	86.5
	272		1.9	1.4992	93.6	1.4705	91.8
	284	30 June 68	0.8	1.4400	89.9	1.4288	89.2
	283		3.3	1.4112	88.1	1.3663	85.3
	301		2.5	1.4640	91.4	1.4272	89.1
	308	5 July 68	3.6	1.4448	90.2	1.3936	87.0
	319		3.6	1.4993	93.6	1.4464	90.3

TABLE II. SAND MOISTURE-DENSITY DATA (Continued)

Test Area	Station No.	Date	Moisture Content %	Wet Density		Dry Density	
				g/cm ³	lb/ft ³	g/cm ³	lb/ft ³
C-72	355	11 July 68	5.5	1.3119	81.9	1.2430	77.6
	366		5.4	1.3375	83.5	1.2686	79.2
	368		3.7	1.2750	79.6	1.1917	74.4
	363		5.6	1.3071	81.6	1.2414	77.5
	386	25 July 68	5.4	1.3215	82.5	1.2542	78.3
	411		5.0	1.3199	82.4	1.2574	78.5
	434	31 July 68	4.6	1.2622	78.8	1.2078	75.4
	441		4.3	1.2670	79.1	1.2142	75.8
	451		5.4	1.2606	78.7	1.1965	74.7
	459		4.9	1.2670	79.1	1.2078	75.4
	489	1 Aug 68	4.3	1.3039	81.4	1.2510	78.1
	474		4.3	1.3215	82.5	1.2670	79.1
	499		5.1	1.2766	79.7	1.2142	75.8
	528	5 Nov 68	4.3	1.3343	83.3	1.2782	79.8
	509		5.1	1.3439	83.9	1.2782	79.8
	554		4.8	1.3359	83.4	1.2750	79.6
	575		4.1	1.3199	82.4	1.2686	79.2
	581		5.6	1.4320	89.4	1.3567	84.7
	614	21 Nov 68	7.2	1.4400	89.9	1.3407	83.7
	603		7.3	1.3647	85.2	1.2718	79.4
	629		6.3	1.4032	87.6	1.3215	82.5
	634		6.7	1.4785	92.3	1.3856	86.5
	649		6.5	1.3503	84.3	1.2686	79.2
	664	26 Nov 68	8.0	1.4304	89.3	1.3247	82.7
	693		8.0	1.9077	119.1	1.4064	87.8
	684		8.5	1.5185	94.8	1.4000	87.4
	688		7.1	1.4849	92.7	1.3872	86.6
	678		7.2	1.5073	94.1	1.4064	87.3

TABLE II. SAND MOISTURE-DENSITY DATA (Continued)

Test Area	Station No.	Date	Moisture Content %	Wet Density		Dry Density	
				g/cm ³	lb/ft ³	g/cm ³	lb/ft ³
B-76	700	25 Feb 69	8.8	1.4416	90.0	1.3247	82.7
	699		7.8	1.414	88.3	1.4192	88.6
	694		8.4	1.6018	100.0	1.3791	86.1
	701		8.5	1.4560	90.9	1.3423	83.8
	702		8.4	1.4016	87.5	1.2927	80.7
C-72	703	28 Feb 69	4.8	1.3151	82.1	1.2558	78.4
	707		3.8	1.3087	81.8	1.2606	78.7
	713	4 Mar 69	5.4	1.3968	87.2	1.3263	82.8
	715		4.6	1.3551	84.6	1.2943	80.8
	719	10 Mar 69	7.0	1.5169	94.7	1.4544	90.8
	723		8.2	1.5041	93.9	1.3904	86.8
	731		6.6	1.4785	92.3	1.3872	86.6
	735		7.4	1.4945	93.3	1.3904	86.8
	759		5.8	1.5105	94.3	1.4288	89.2
	739		5.8	1.4288	89.2	1.3503	84.3
	727		7.3	1.4897	93.0	1.3872	86.6
	775		5.6	1.4865	92.8	1.4048	87.7
	767		7.0	1.4961	93.4	1.3984	87.3
	779	25 Mar 69	7.9	1.4977	93.5	1.3888	86.7
	783		7.2	1.4672	91.6	1.3679	85.4
	789		6.2	1.6018	100.0	1.3727	85.7
	793		5.6	1.4416	90.0	1.3647	85.2
	797	26 Mar 69	7.1	1.5121	94.4	1.4128	88.2
			6.4	1.4336	89.5	1.3471	84.1
			9.3	1.4480	90.4	1.3247	82.7
	801	28 Mar 69	5.3	1.4272	89.1	1.3567	84.7

TABLE II. SAND MOISTURE-DENSITY DATA (Concluded)

Test Area	Station No.	Date	Moisture Content %	Wet Density		Dry Density	
				g/cm ³	lb/ft ³	g/cm ³	lb/ft ³
C-72	805	2 Apr 69	4.9	1.3808	86.2	1.3151	82.1
	809	23 Apr 69	4.8	1.2959	80.9	1.2382	77.3
	821	25 Apr 69	5.1	1.3039	81.4	1.2398	77.4
	825		5.4	1.3663	85.3	1.2959	80.9
	829		4.8	1.4176	88.5	1.3519	84.4
	837		4.5	1.430	89.3	1.3679	85.4
	833		6.0	1.3055	81.5	1.2318	76.9
	813		4.4	1.3295	83.0	1.2718	79.4
	817		5.3	1.2446	77.7	1.1821	73.8
	853	29 Apr 69	4.1	1.3135	82.0	1.2927	80.7
	857		3.8	1.3263	82.8	1.2782	79.8
	849		3.7	1.3183	82.3	1.2702	79.3
	841		5.1	1.3471	84.1	1.2862	80.3
	845		5.3	1.3808	86.2	1.3119	81.9
	861	6 May 69	4.0	1.3167	82.2	1.2654	79.0
	865		3.5	1.3455	84.0	1.3007	81.2
	869		4.5	1.2622	78.8	1.2078	75.4
	873		4.3	1.3119	81.9	1.2574	78.5
	877	23 May 69	4.7	1.3647	85.2	1.3039	81.4

SECTION IV

ANALYSIS

1. MEASUREMENTS OF VARIABLES

An examination of the measurements of the variables indicates how homogenous the test media was prepared. Since the soil sample came from the 5.0 cm (2 inch) to 10.1 cm (4 inch) depth band, the penetrometer, P, reading at a depth of 7.5 cm (3 inches) was chosen to correspond with the dry density, D, and percentage moisture, M. Data obtained from station numbers 694, 699, 700, 701, and 702 were not included in the analysis as they represented static tests conducted where the soil was not tilled. A frequency plot of each variable by range is found on Figures 13, 14, and 15. Additional properties of the variables may be found in Table III.

The coefficient of variation describes the amount of variation of each variable and is defined:

$$C = \frac{s}{\bar{x}} \times 100$$

where C is the coefficient of variation

s is the standard deviation of the variable and

\bar{x} is the mean deviation of the variable, expressed in percent.

C is relative to the magnitude of the mean.

The standard error is defined as follows:

$$\frac{s}{\bar{x}} = \frac{s}{n}$$

where: s is the standard deviation of the mean and

\bar{x} n is the number of samples.

The standard error from combining both ranges indicates a good estimate was obtained for the variable means. Plots of confidence levels on variable means, with the standard errors noted, are found on Figures 16, 17, and 18.

Table IV contains the average cone index values for all penetrometer readings taken on TA's B-76 and C-72, and the combined ranges. Figures 16, 17, and 18 show the confidence band width at any desired confidence levels from 50 to 99.9 percent.

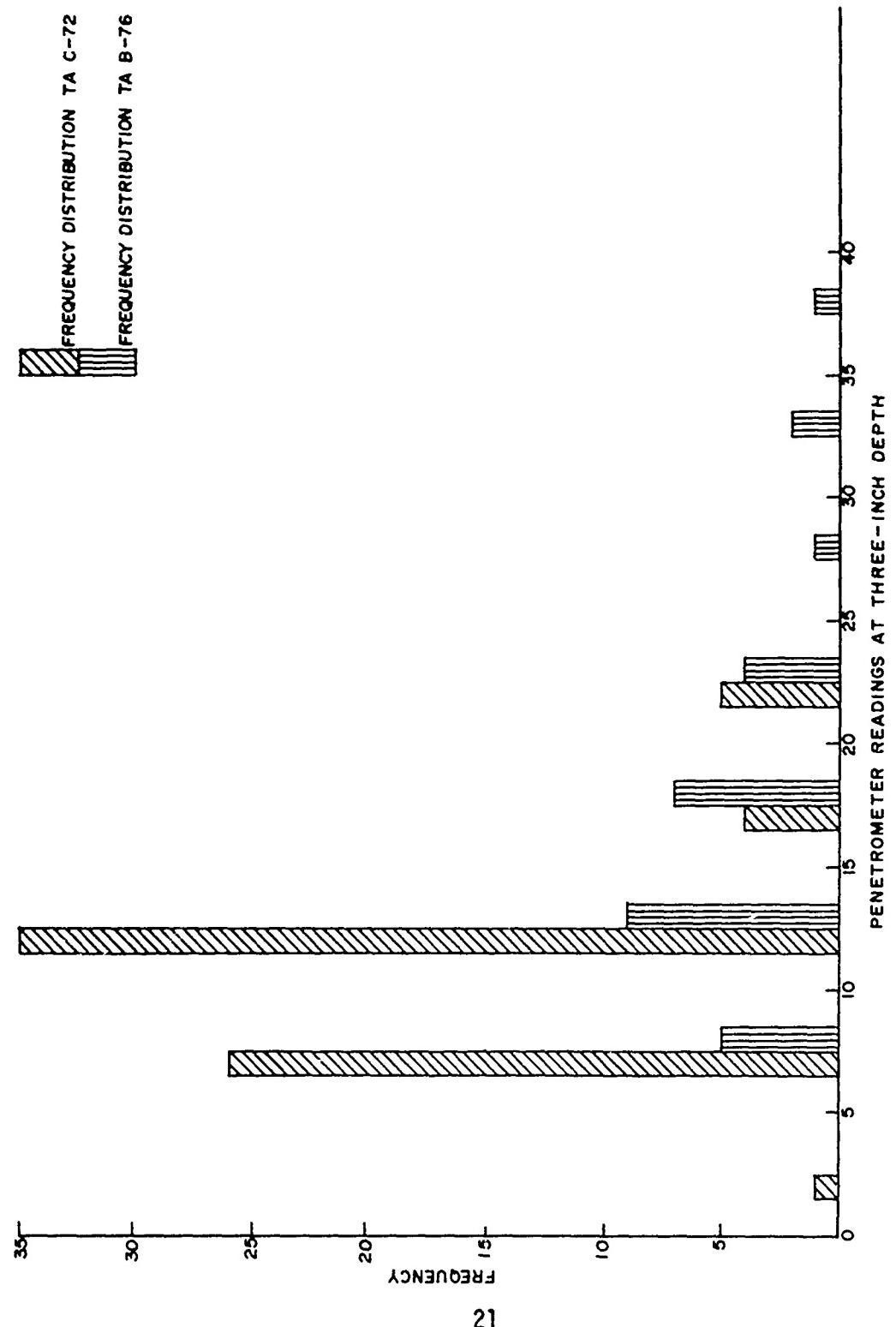


Figure 13. Penetrometer Readings at Three-Inch Depth, Frequency Distribution

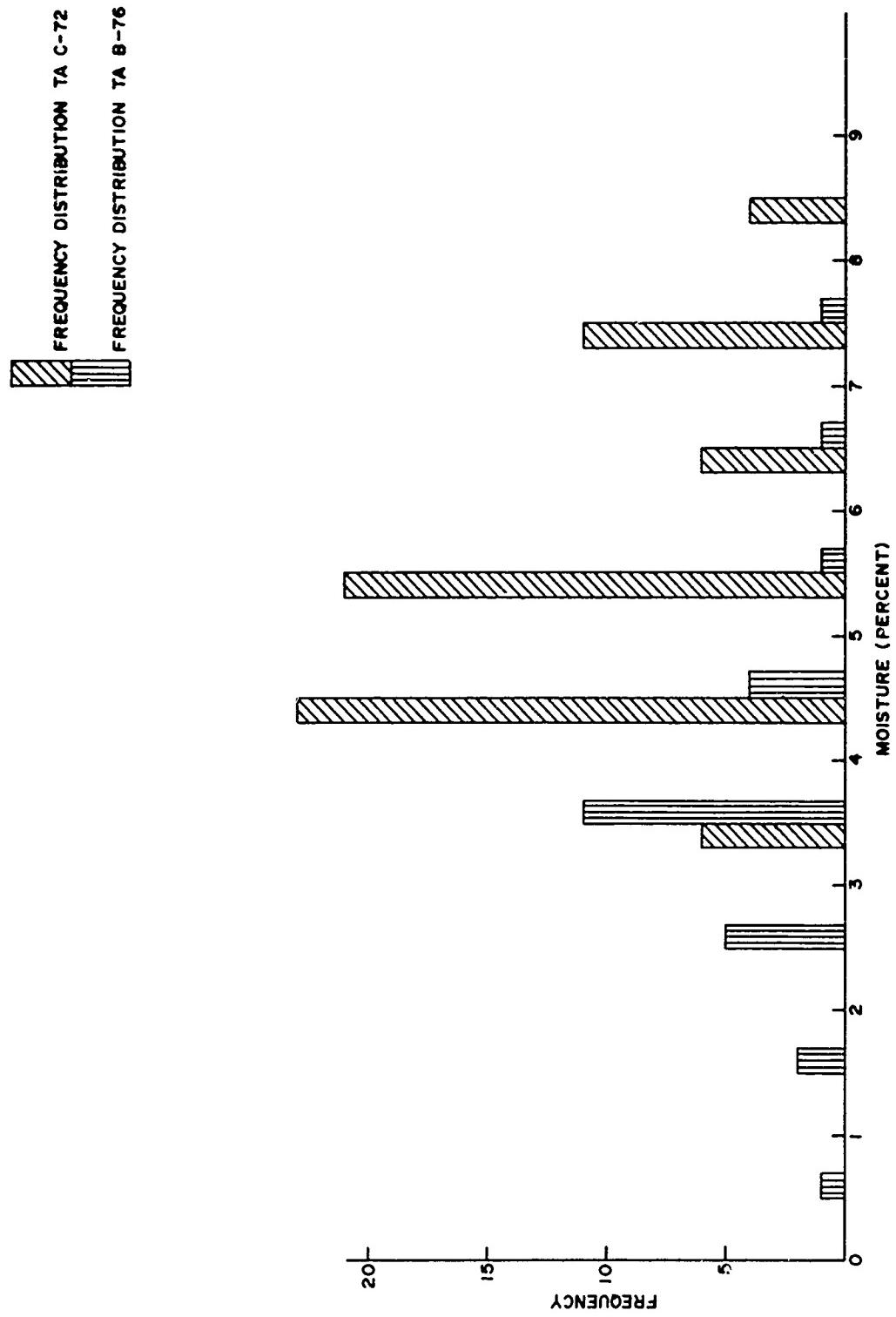


Figure 14. Percent Moisture, Frequency Distribution

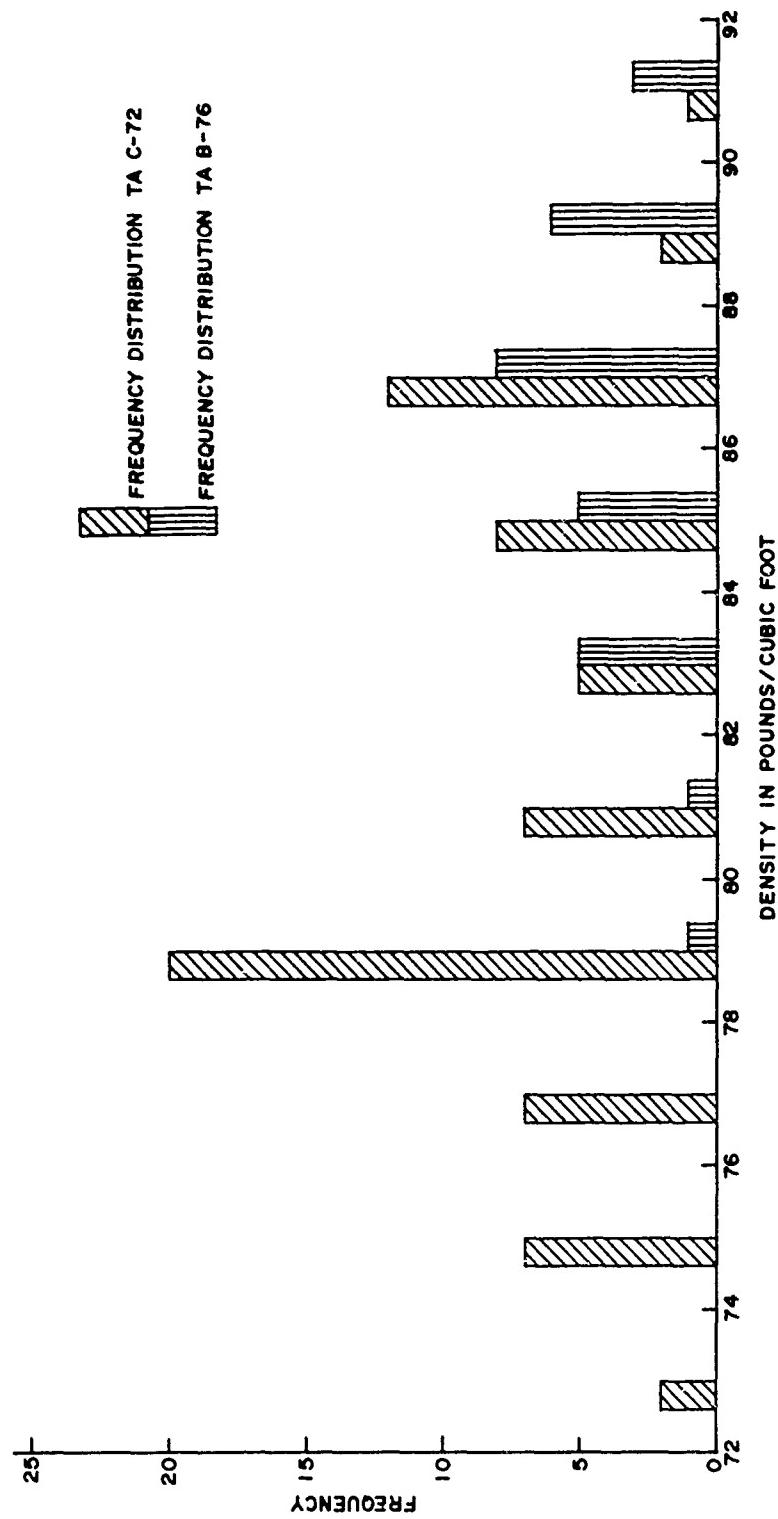


Figure 15. Density Reading, Frequency Distribution

TABLE III - MEASUREMENTS OF VARIABLES

Test Area	Variable	n	Mean \bar{x}	Standard Deviation s	Variance s^2	High Point	Low Point	Coefficient of Variation	Mean Standard Error $s_{\bar{x}}$
C-72	D	71	81.25	4.38	19.18	90.8	72.1	5.4 %	0.5198
	M	71	5.48	1.28	1.63	8.5	3.5	23.4 %	0.1519
	P	71	12.23	4.27	18.26	24.0	6.0	34.9 %	0.5068
B-76	D	29	86.22	3.04	9.22	91.8	82.3	3.5 %	0.5645
	M	29	3.44	1.41	2.00	7.7	0.8	41.0 %	0.2618
	P	29	17.83	8.12	65.86	38.0	6.0	45.5 %	1.5078
COMBINED	D	100	82.70	4.62	21.31	91.8	72.1	5.6 %	0.462
	M	100	4.89	1.61	2.58	8.5	0.8	32.9 %	0.161
	P	100	13.85	6.17	38.07	38.0	6.0	44.5 %	0.617

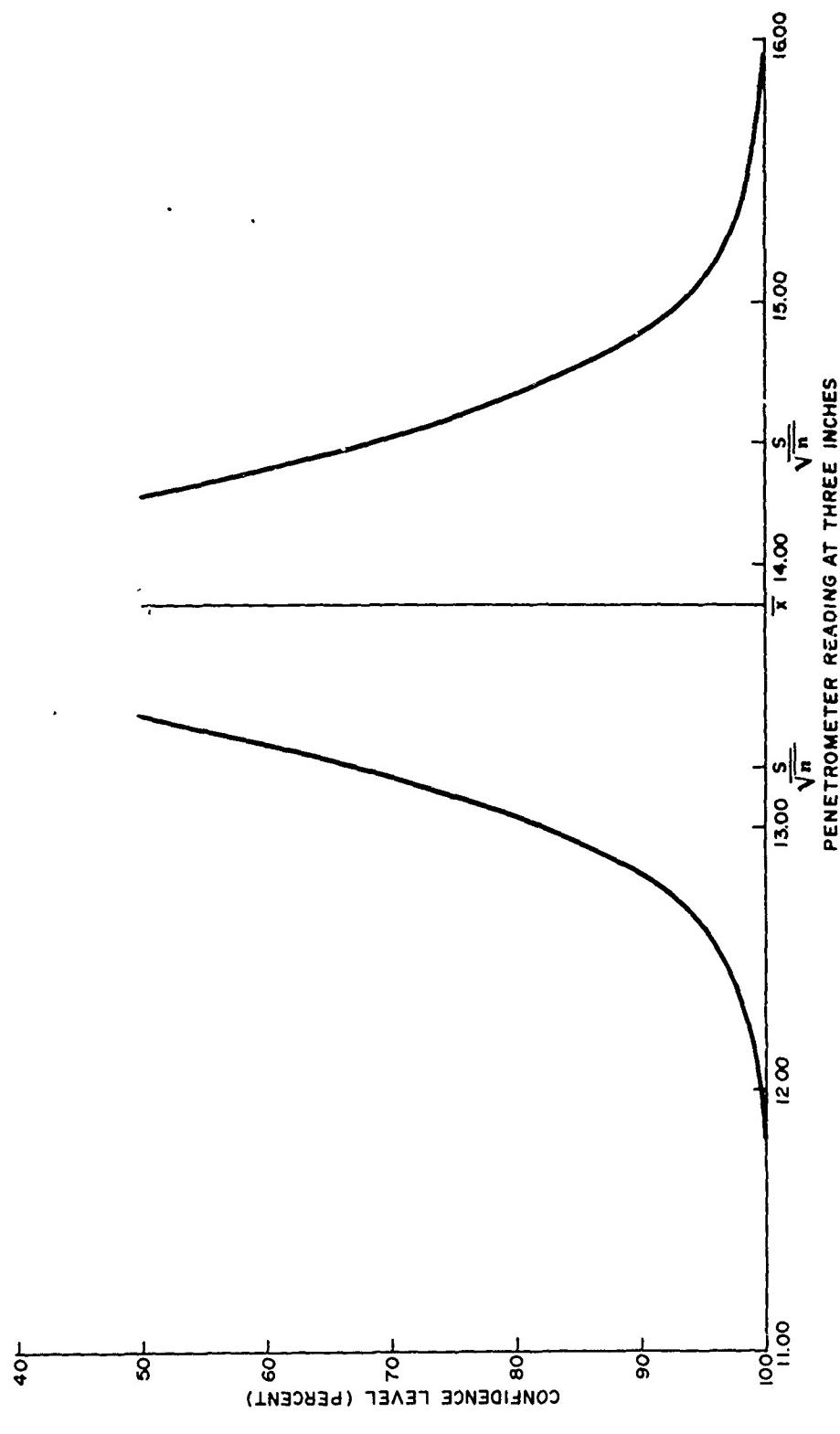


Figure 16. Confidence Level About Penetrometer Mean-Combined Ranges

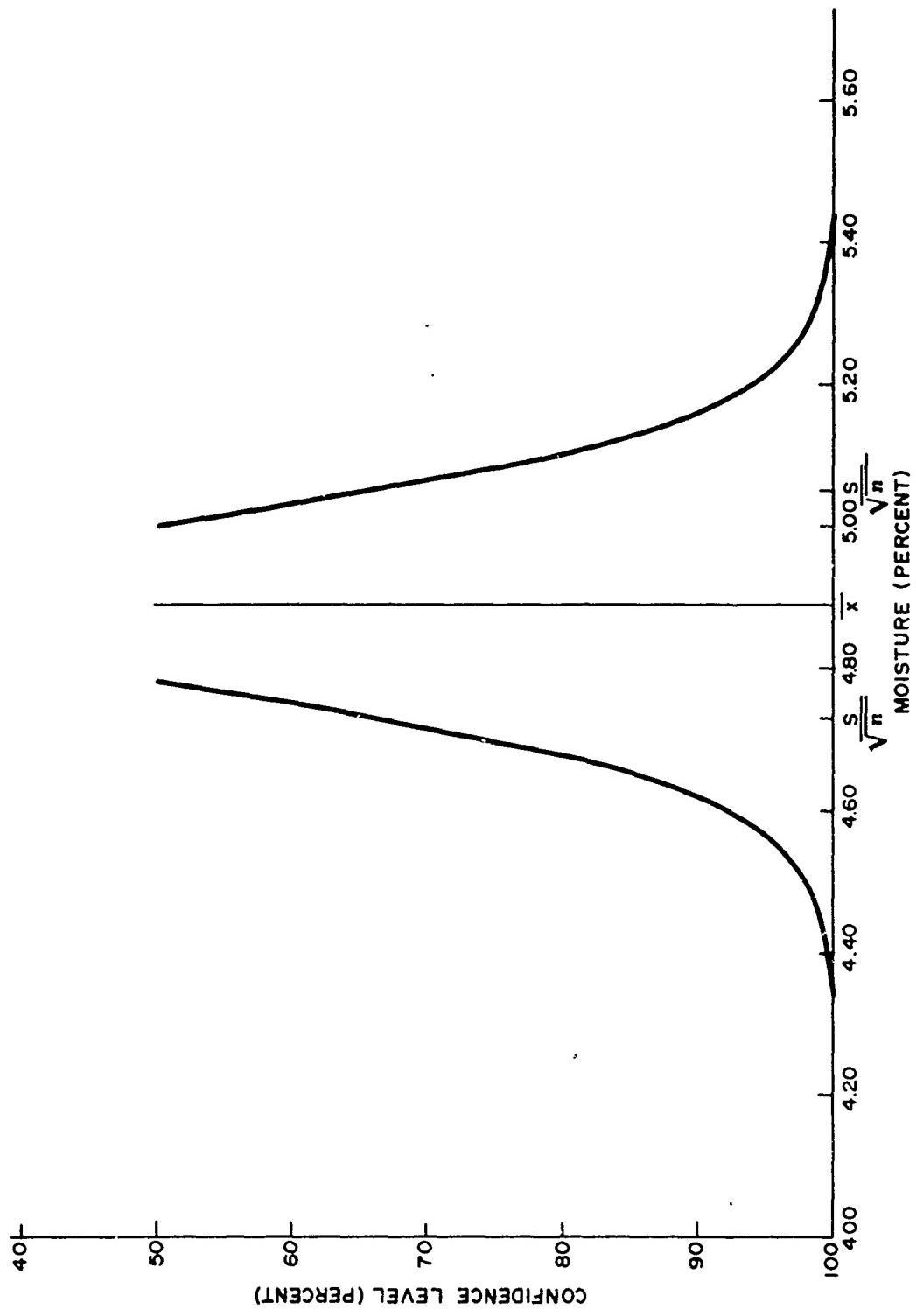


Figure 17. Confidence Level About Percent Moisture Mean-Combined Ranges

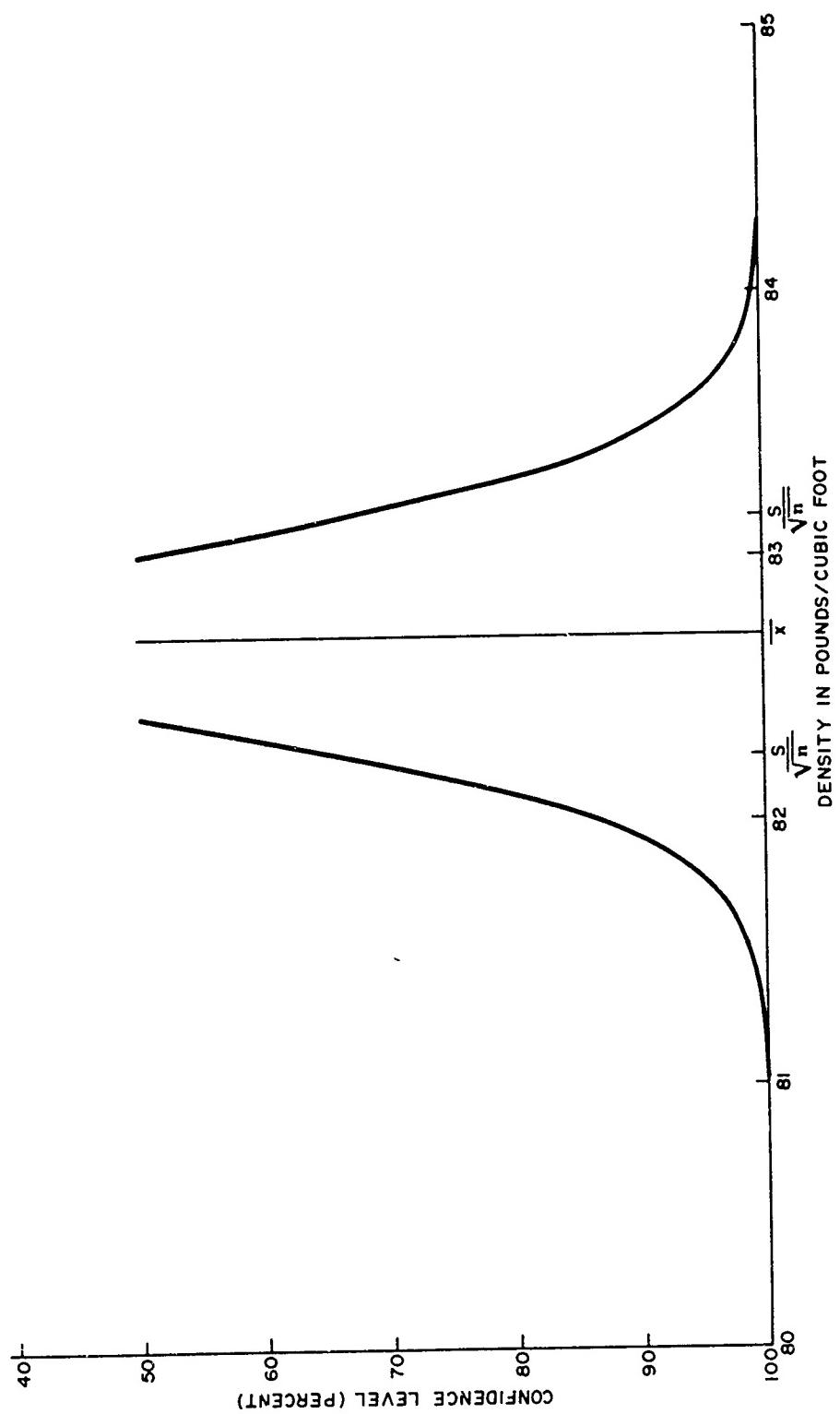


Figure 18. Confidence Level About Density Mean-Combined Ranges

TABLE IV - CONE INDEX READINGS

Test Area	Average Cone Index Readings at Depths in Centimeters						
	0.0	2.5	5.0	7.5	10.0	12.5	15.0
C-72	5	8	10	11	13	15	18
B-76	8	8	12	16	19	22	26
COMBINED	6	8	11	12	14	16	19
						26	53
						46	84
						31	60

2. RELATIONSHIP OF VARIABLES

A plot of the raw data, using paired variables, failed to show much of a relation (Figures 19, 20, and 21). Calculation of their correlation coefficient, r , is another method of measuring the relationship of the paired variables:

$$r = \frac{\sum (x_i - \bar{x})(y_i - \bar{y})}{\sqrt{[\sum (x_i - \bar{x})^2][\sum (y_i - \bar{y})^2]}}$$

The correlation coefficient measures the degree of closeness of the linear relationship between paired variables. The correlation coefficient is dimensionless and lies between ± 1 . When the variables tend to increase together, r will be positive; when one tends to increase and the other decrease, r will be negative. Values of ± 1 denote perfect correlation between the paired variables, while $r = 0$ denotes no correlation. See Table V.

An analysis of variance table was calculated to see if a statistical relation existed. It was found that the sum of squares due to fitting the slope was so small that it had no effect upon predicting a dependent variable. The residual mean squares are given in Table V. The same residual mean square value was obtained for the dependent variable regardless of the independent variable.

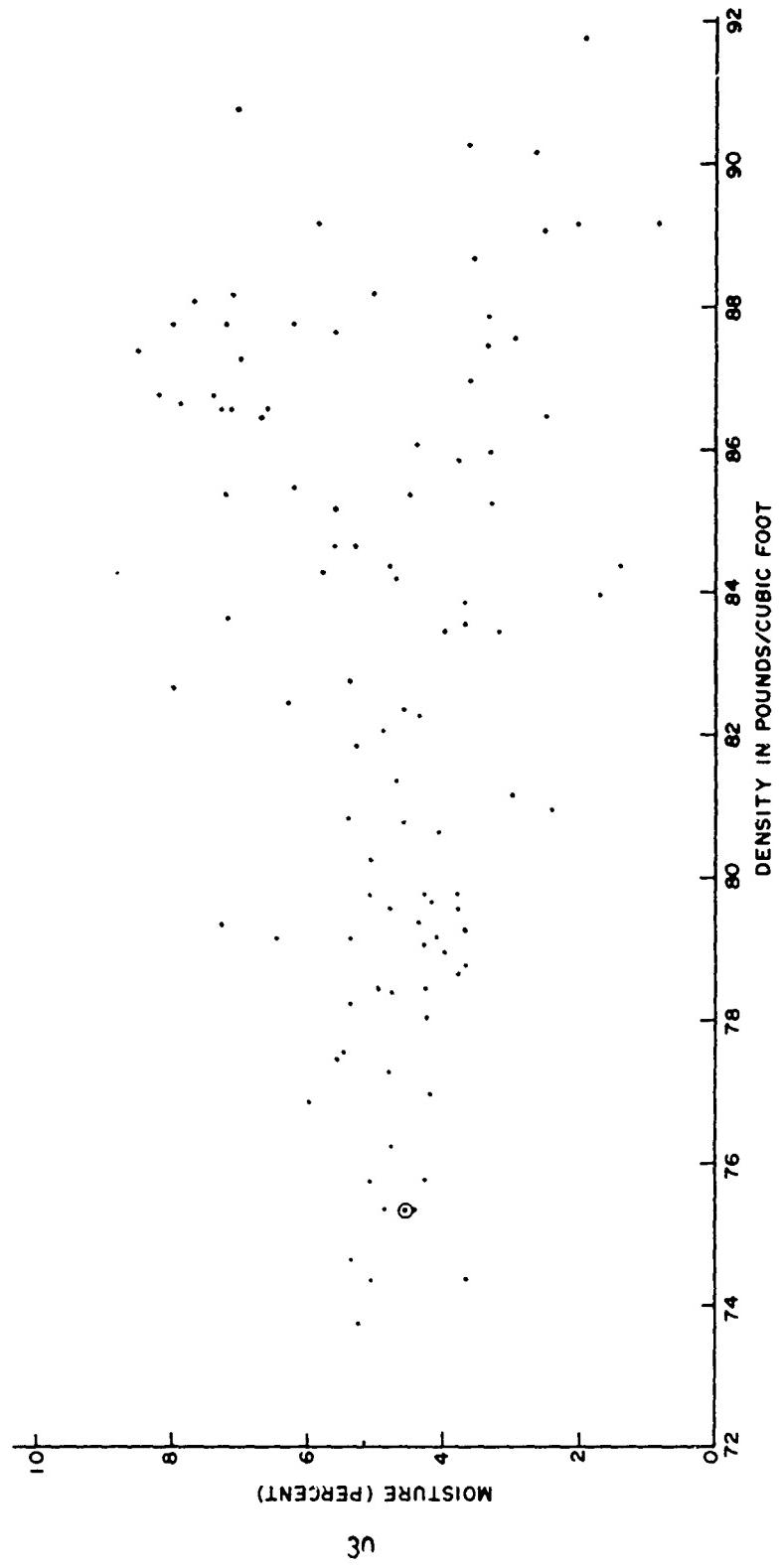


Figure 19. Moisture vs Density (Raw Data)-Combined Ranges

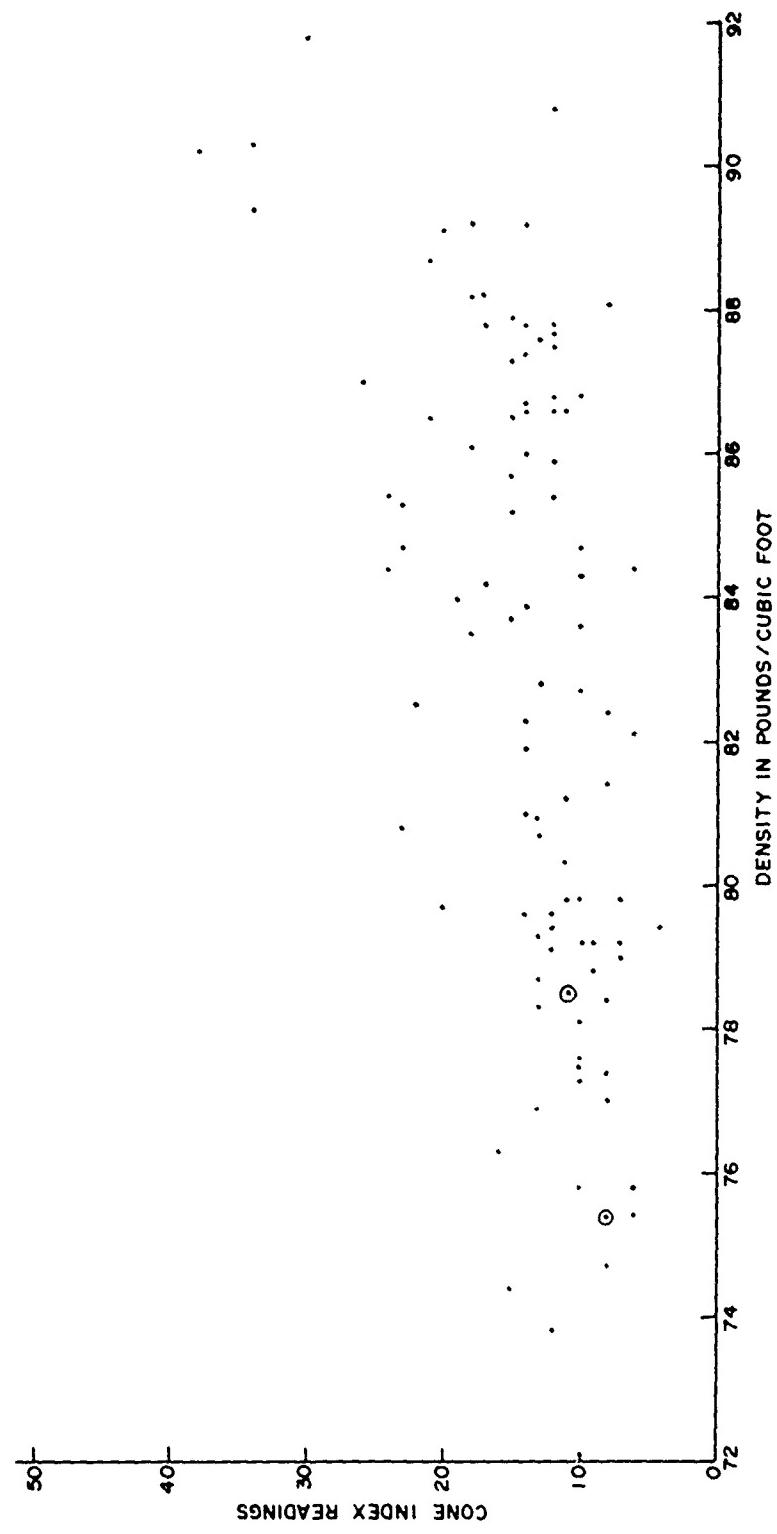


Figure 20. Penetrometer Readings vs Density (Raw Data) - Combined Ranges

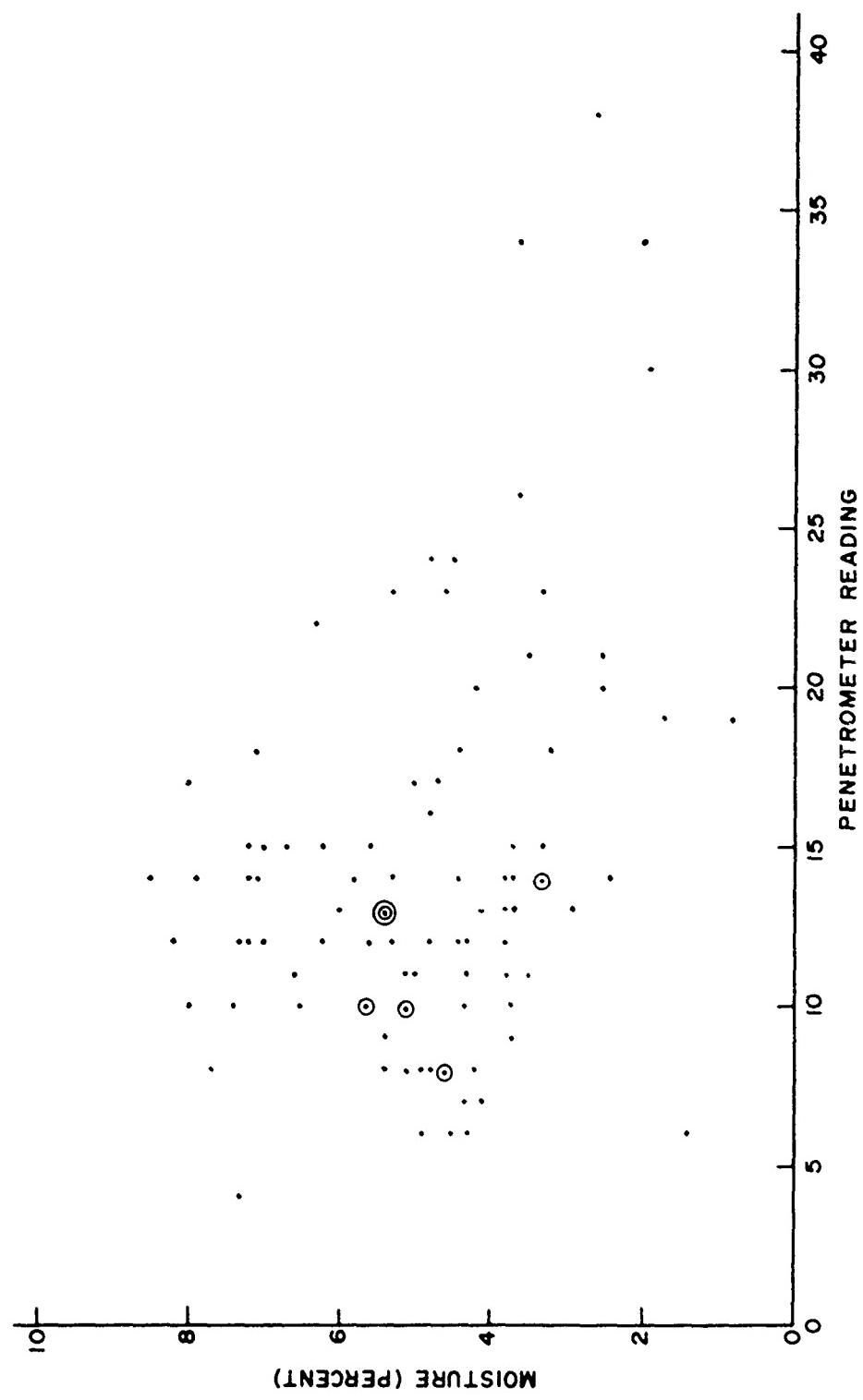


Figure 21. Moisture vs Penetrometer Readings (Raw Data)-Combined Ranges

TABLE V - CORRELATION COEFFICIENTS AND RESIDUAL MEAN SQUARES

TEST AREA	CORRELATION COEFFICIENT		RESIDUAL MEAN SQUARE (WHEN THE VARIABLE WAS A DEPENDENT VARIABLE)			
	P, M	P, D	D, M	P	D	M
B-76	-0.3537	0.6148	-0.1016	68.30	9.57	2.07
C-72	-0.1780	0.4124	0.6476	18.53	19.46	1.65
COMBINED	-0.3093	0.5454	0.0433	38.46	21.53	2.57

SECTION V

CONCLUSION

It should be emphasized that the data are based on a unique environment and the results should not be applied to other environments. Variation in the individual variables from range-to-range can be seen in the frequency plots (Figures 13 through 15) and in the means (Table II). The coefficient of variation indicated a large spread of each variable except density, but the standard error indicates that a good estimate of the means was obtained.

Only density had a small variation. Moisture may have been affected by range location or weather conditions while human error or ability to till properly may have affected the penetrometer readings.

When the data from both ranges are combined, the resultant outcomes are biased toward TA C-72 because of the number of data points. The variations between ranges indicate the difficulty in attempting to predict outcomes in other locations, assuming similar conditions.

The analysis of variance table showed that the variables are independent of each other. Predicting a variable by guessing its mean is as accurate as calculating it from a regression equation.

APPENDIX

PENETROMETER READINGS

AT

TEST AREAS B-76 AND C-72

35

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PENETROMETER DATA

1 MAY 64 RANGE 76 LINE NO. 110

DATA COLLECTED FROM 0901 TO 0924 HRS

PENETROMETER WITH 0-100 DIAL GAGE AND 3.22 SQ CM CONE

POSITION IN CENTIMETERS			STATION	CONE	INDEX	READINGS	AT DEPTHS			IN CENTIMETERS		
X	Y	NO.		0.0	2.5	5.0	7.5	10.0	12.5	15.0	22.5	30.0
2900	2070	1		003	008	011	014	016	018	021	028	072
2992	2070	2		003	008	010	012	014	017	019	030	084
3084	2070	3		004	008	010	012	014	017	019	026	072
3176	2070	4		004	008	010	011	014	016	019	025	066
3268	2070	5		004	008	011	012	014	017	019	030	070
3360	2070	6		004	008	010	013	014	016	018	024	066
3360	2170	7		002	005	006	008	010	013	014	024	060
3268	2170	8		004	008	010	012	014	015	018	030	076
3176	2170	9		004	008	010	011	013	015	018	028	066
3084	2170	10		004	007	010	011	013	014	018	028	068
2992	2170	11		004	009	011	012	014	014	018	030	090
2900	2170	12		004	008	011	013	014	017	020	030	100
2900	2270	13		004	008	011	012	013	014	019	020	022
2992	2270	14		004	010	011	013	014	016	020	026	074
3084	2270	15		004	008	011	012	014	016	019	024	074
3176	2270	16		004	009	011	014	016	018	020	026	080
3268	2270	17		004	008	010	012	013	014	018	028	074
3360	2270	18		003	008	010	012	013	016	019	026	060
3360	2370	19		003	009	010	012	016	022	024	032	070
3268	2370	20		005	010	012	013	014	018	022	032	062
3176	2370	21		005	009	011	013	014	017	020	028	070
3084	2370	22		004	009	012	013	018	018	021	030	068
2992	2370	23		004	009	012	014	017	022	024	036	070
2900	2370	24		004	009	010	012	014	018	020	034	066
AVERAGE CI AT EACH DEPTH				004	008	010	012	014	017	019	028	070

PENETROMETER DATA

6 MAY 64 RANGE 76 LINE NO. 153

DATA COLLECTED FROM 0850 TO 0905 HRS

PENETROMETER WITH 0-100 DIAL GAGE AND 3.22 SQ CM CONE

POSITION IN CENTIMETERS			STATION	CONE	INDEX	READINGS	AT DEPTHS			IN CENTIMETERS		
X	Y	NO.		0.0	2.5	5.0	7.5	10.0	12.5	15.0	22.5	30.0
2070	2900	25		005	010	012	014	018	021	028	052	096
2170	2900	26		005	009	010	013	015	022	026	058	100
2270	2900	27		004	006	007	008	010	012	014	056	100
2370	2900	28		004	006	007	003	009	010	014	052	094
2370	3050	29		002	003	004	006	007	008	012	054	096
2270	3050	30		002	003	004	006	008	008	010	052	096
2170	3150	31		002	005	006	007	008	010	016	072	100
2070	3050	32		003	006	009	010	012	014	018	058	100
2070	3200	33		005	014	015	017	020	024	030	054	100
2170	3200	34		004	013	016	018	021	024	028	060	100
2270	3200	35		004	010	012	015	020	022	030	072	094
2370	3200	36		004	010	012	015	016	021	028	054	100
2370	3350	37		004	010	013	014	017	022	028	074	100
2270	3350	38		005	010	014	015	019	024	032	086	100
2170	3350	39		005	012	014	015	018	022	030	076	100
2070	3350	40		004	010	012	015	018	024	028	092	100
AVERAGE CI AT EACH DEPTH				004	009	010	012	015	018	023	064	099

PENETROMETER DATA

7 MAY 63 RANGE 76 LINE NO. 181/182

DATA COLLECTED FROM TO HRS

PENETROMETER WITH 0-100 DIAL GAGE AND 3.22 SQ CM CONE

POSITION IN CENTIMETERS	STATION	CONE INDEX	READINGS AT DEPTHS IN CENTIMETERS
X	Y	NO.	0.0 2.5 5.0 7.5 10.0 12.5 15.0 22.5 30.0
1900	3000	41	004 008 009 010 012 014 018 032 100
2200	3000	42	002 005 006 008 009 012 014 022 100
2600	3000	43	002 004 006 007 008 009 010 014 100
2900	3000	44	004 009 010 012 013 014 016 024 050
3100	3000	45	005 010 014 015 016 019 022 036 090
3400	3000	46	004 009 010 011 013 015 018 026 072
3700	3000	47	004 006 008 009 010 010 012 018 066
4000	3000	48	003 008 009 010 011 012 014 022 040
4300	3000	49	006 012 015 017 020 022 016 040 100
4300	3200	50	005 010 016 018 022 023 024 036 082
4000	3200	51	006 012 015 018 020 022 023 032 060
3700	3200	52	003 006 008 010 010 012 013 020 040
3400	3200	53	003 006 008 009 010 012 014 019 076
3100	3200	54	005 012 014 015 017 020 022 032 048
2800	3200	55	006 009 011 012 013 014 015 025 048
2500	3200	56	002 005 008 003 010 012 014 020 052
2200	3200	57	003 005 007 008 010 010 012 018 100
1900	3200	58	006 011 014 014 018 022 028 042 100
1900	3400	59	004 012 014 014 016 019 022 037 057
2200	3400	60	003 006 008 010 010 012 015 018 072
2500	3400	61	002 005 006 008 010 011 012 018 048
2800	3400	62	004 008 010 011 012 015 020 026 042
3100	3400	63	006 010 014 015 015 017 022 030 080
3400	3400	64	005 008 010 012 014 016 017 020 058
3700	3400	65	004 008 008 010 011 013 015 020 090
4000	3400	66	004 007 010 011 012 014 016 026 100
4300	3400	67	005 010 012 012 013 014 019 026 072
4300	3600	68	004 006 007 008 010 010 012 022 100
4000	3600	69	004 006 008 009 010 012 014 026 084
3700	3600	70	003 005 008 008 009 011 013 026 092
3400	3600	71	004 010 014 014 015 018 022 040 100
3100	3600	72	005 010 012 014 014 015 018 028 064
2800	3600	73	004 010 010 012 014 018 021 038 076
2500	3600	74	005 008 010 011 012 013 015 026 054
2200	3600	75	004 008 010 012 012 014 015 022 060
1900	3600	76	004 010 010 012 014 014 018 032 080
AVERAGE CI AT EACH DEPTH			004 008 010 011 013 015 017 027 074

PENETROMETER DATA

8 MAY 68 RANGE 76 LINE NO. 181/182

DATA COLLECTED FROM TO HRS

PENETROMETER WITH 0-100 DIAL GAGE AND 3.22 SQ CM CONE

POSITION IN CENTIMETERS	STATION	CONE INDEX	READINGS	AT DEPTHS	IN CENTIMETERS						
X	Y	NO.	0.0	2.5	5.0	7.5	10.0	12.5	15.0	22.5	30.0
2650	3000	77	009	011	013	014	016	020	028	062	100
2950	3000	78	008	011	011	012	013	016	023	062	100
3250	3000	79	015	020	021	026	030	036	046	084	100
3550	3000	80	011	013	014	014	016	022	026	066	100
3550	3200	81	012	013	014	015	016	019	023	052	100
3250	3200	82	002	003	004	004	005	007	011	042	070
2950	3200	83	006	010	011	013	014	018	034	062	100
2650	3200	84	006	008	009	010	010	014	022	050	100
2650	3400	85	005	007	009	009	010	012	016	060	100
2950	3400	86	010	015	015	015	022	028	036	080	100
3250	3400	87	008	011	014	016	020	028	040	100	100
3550	3400	88	002	004	006	006	007	009	012	036	100
3550	3600	89	005	008	009	010	011	011	014	024	086
3250	3600	90	004	006	006	007	008	009	010	028	090
2950	3600	91	002	003	004	004	005	005	006	032	100
2650	3600	92	002	004	004	006	006	007	008	046	100
AVERAGE CI AT EACH DEPTH			007	009	010	012	013	016	022	055	097

PENETROMETER DATA

9 MAY 68 RANGE 76 LINE NO. 194

DATA COLLECTED FROM TO HRS

PENETROMETER WITH 0-100 DIAL GAGE AND 3.22 SQ CM CONE

POSITION IN CENTIMETERS	STATION	CONE INDEX	READINGS	AT DEPTHS	IN CENTIMETERS						
X	Y	NO.	0.0	2.5	5.0	7.5	10.0	12.5	15.0	22.5	30.0
2200	3000	93	007	012	015	018	022	025	031	057	100
2500	3000	94	007	013	016	017	021	026	032	052	100
2800	3000	95	007	012	015	019	025	030	037	054	100
3100	3000	96	007	015	015	019	024	028	036	056	100
3400	3000	97	004	012	015	015	020	025	031	052	100
3700	3000	98	007	011	015	018	022	026	034	058	100
4000	3000	99	006	009	010	013	015	020	024	044	100
4000	3200	100	003	006	008	009	012	014	015	040	100
3700	3200	101	003	007	010	013	014	016	018	040	100
3400	3200	102	002	005	007	009	011	012	013	030	100
3100	3200	103	003	006	010	014	014	014	013	034	100
2800	3200	104	002	005	008	011	011	012	012	036	100
2500	3200	105	003	006	009	012	014	014	016	022	100
2200	3200	106	004	010	011	012	014	017	019	027	100
2200	3400	107	002	004	007	010	010	010	012	032	100
2500	3400	108	002	005	006	008	009	011	011	034	100
2800	3400	109	003	006	007	007	011	011	014	038	100
3100	3400	110	003	005	007	008	010	012	014	034	100
3400	3400	111	002	004	006	008	010	011	014	048	100
3700	3400	112	002	005	005	007	009	012	013	038	100
4000	3400	113	002	004	007	008	010	011	012	040	100
4000	3600	114	002	004	005	008	011	011	016	024	100
3700	3600	115	004	039	009	012	012	016	018	054	100
3400	3600	116	004	008	010	012	016	020	024	054	100
3100	3600	117	005	010	013	014	016	021	027	046	100
2800	3600	118	007	013	017	022	028	034	044	070	100
2500	3600	119	005	011	012	014	015	019	024	048	100
2200	3600	120	004	008	012	012	014	016	022	040	100
AVERAGE CI AT EACH DEPTH			004	008	010	013	015	018	021	043	100

PENETROMETER DATA

10 MAY 63 RANGE 76 LINE NO. 128

DATA COLLECTED FROM TO HRS

PENETROMETER WITH 0-100 DIAL GAGE AND 3.22 SQ CM CONE

POSITION IN CENTIMETERS		STATION	CONE INDEX	READINGS	AT DEPTHS IN CENTIMETERS						
X	Y	NO.	0.0	2.5	5.0	7.5	10.0	12.5	15.0	22.5	30.0
2850	2050	121	063	012	019	021	028	036	042	070	100
2950	2050	122	002	005	014	019	024	028	036	054	100
3050	2050	123	002	010	026	042	048	054	062	084	100
3150	2050	124	004	014	032	042	046	054	062	084	100
3250	2050	125	002	008	014	023	028	034	042	050	100
3350	2050	126	002	008	020	022	038	049	050	060	100
3350	2350	127	002	008	010	014	018	022	024	046	100
3250	2350	128	002	008	014	019	022	026	030	034	080
3150	2350	129	002	006	012	014	014	018	018	046	100
3050	2350	130	002	006	012	014	018	014	014	020	100
2950	2350	131	002	012	020	022	024	026	026	026	065
2950	2350	132	002	013	012	014	016	020	022	022	084
AVERAGE CI AT EACH DEPTH			002	009	017	022	027	032	036	050	094

PENETROMETER DATA

13 MAY 63 RANGE 76 LINE NO. 128

DATA COLLECTED FROM TO HRS

PENETROMETER WITH 0-100 DIAL GAGE AND 3.22 SQ CM CONE

POSITION IN CENTIMETERS		STATION	CONE INDEX	READINGS	AT DEPTHS IN CENTIMETERS						
X	Y	NO.	0.0	2.5	5.0	7.5	10.0	12.5	15.0	22.5	30.0
2200	3000	133	004	010	023	038	048	050	058	090	100
2500	3000	134	004	010	030	040	048	050	052	078	100
2800	3000	135	006	014	032	046	052	054	058	100	100
3100	3000	136	003	009	018	030	040	050	056	092	100
3400	3000	137	004	012	026	032	044	050	054	062	100
3700	3000	138	002	008	020	030	042	050	054	078	100
4000	3000	139	002	006	016	034	044	052	054	096	100
4000	3200	140	001	004	010	018	026	034	054	100	100
3700	3200	141	002	008	016	024	030	032	038	060	100
3400	3200	142	004	012	014	018	022	024	028	050	100
3100	3200	143	006	018	020	020	028	028	030	050	100
2800	3200	144	003	010	018	022	026	028	032	072	100
2500	3200	145	002	010	013	015	016	018	018	062	100
2200	3200	146	002	004	011	014	016	016	017	040	100
2200	3400	147	004	014	020	024	024	028	030	044	100
2500	3400	148	004	012	020	024	026	030	036	070	100
2800	3400	149	004	012	020	024	026	037	050	100	100
3100	3400	150	003	009	014	018	020	021	024	031	100
3400	3400	151	002	006	014	024	029	030	031	100	100
3700	3400	152	006	016	021	021	022	025	026	052	100
4000	3400	153	006	016	018	019	020	020	021	029	100
4000	3600	154	003	007	012	015	016	016	016	100	100
3700	3600	155	002	014	021	023	026	034	037	058	100
3400	3600	156	002	010	022	025	027	030	036	066	100
3100	3600	157	008	028	028	030	031	038	042	050	100
2800	3600	158	002	009	024	032	036	040	044	064	100
2500	3600	159	002	012	020	024	026	031	036	076	100
2200	3600	160	002	008	016	022	024	026	030	052	100
AVERAGE CI AT EACH DEPTH			003	011	019	025	030	034	038	069	100

PENETROMETER DATA

27 JUNE 58 PANGE 72 LINE NO. 161/162-223
 DATA COLLECTED FROM STATION NO. 161-248, 0928 TO 1055 HRS
 STATION NO. 249-252, 1513 TO 1516 HRS
 STATION NO. 253-255, 1518 TO 1520 HRS

PENETROMETER WITH 0-100 DIAL GAGE AND 3.22 SQ CM CONE

POSITION IN CENTIMETERS		STATION	CONE INDEX	READINGS	AT DEPTHS	IN CENTIMETERS					
X	Y	NO.	0.0	2.5	5.0	7.5	10.0	12.5	15.0	22.5	30.0
0000	4600	161	001	004	005	006	006	007	008	014	024
2000	4600	162	002	005	007	003	008	009	011	016	026
4000	4600	163	002	006	007	007	008	009	010	015	027
8000	4600	164	002	007	009	011	011	011	013	018	034
10000	4600	165	001	003	006	009	011	012	013	017	026
12000	4600	166	002	007	008	009	009	010	012	017	030
14000	4600	167	004	008	010	012	012	013	015	021	042
16000	4600	168	002	006	008	010	013	015	016	018	024
16000	4900	169	002	006	008	003	009	009	013	018	026
14000	4900	170	004	009	011	012	012	013	015	024	035
12000	4900	171	003	005	008	010	011	012	015	019	032
10000	4900	172	002	005	007	007	008	011	013	020	032
8000	4900	173	002	006	009	009	010	011	014	018	052
4000	4900	174	002	007	009	010	011	014	014	020	042
2000	4900	175	005	010	012	012	013	013	015	023	038
0000	4900	176	005	010	010	011	011	013	016	026	044
0000	5200	177	002	007	008	003	009	011	014	019	026
2000	5200	178	002	006	009	010	011	012	014	024	042
4000	5200	179	002	007	008	010	011	012	013	018	040
8000	5200	180	002	007	009	011	012	013	016	030	048
10000	5200	181	002	007	008	009	010	012	014	020	034
12000	5200	182	002	009	009	010	012	013	015	023	040
14000	5200	183	005	012	014	014	015	016	016	027	050
22000	5200	184	004	010	014	016	019	020	024	040	100
22000	5600	185	004	008	010	011	012	012	013	020	100
14000	5600	186	003	007	008	008	009	011	013	018	034
12000	5600	187	003	009	012	012	013	014	016	027	042
10000	5600	188	003	007	007	009	009	011	014	018	032
8000	5600	189	003	005	007	008	008	010	012	018	028
4000	5600	190	004	012	017	017	017	017	020	032	058
2000	5600	191	003	007	008	009	010	012	014	020	036
0000	5600	192	002	006	007	003	009	010	012	026	046
0000	6300	193	002	005	005	006	007	009	011	015	023
2000	6300	194	002	005	007	008	009	010	011	023	030
4000	6300	195	002	005	007	009	009	012	014	018	030
8000	6300	196	002	004	005	006	009	011	012	014	028
10000	6300	197	003	006	008	009	010	012	013	020	036
12000	6300	198	002	005	006	007	009	011	013	018	034
14000	6300	199	005	011	013	014	014	014	016	030	050
22000	6300	200	002	007	009	010	011	012	015	019	030
22000	6700	201	005	007	010	011	011	011	012	020	030
14000	6700	202	002	005	007	008	010	012	014	019	036
12000	6700	203	003	007	010	011	012	014	016	022	034
10000	6700	204	004	008	010	011	011	013	015	022	038
8000	6700	205	002	005	007	008	010	012	014	019	027
4000	6700	206	003	005	007	010	010	010	012	018	030
2000	6700	207	002	004	006	007	008	010	012	016	037
0000	6700	208	002	003	004	006	008	010	011	015	027
0000	7000	209	002	006	007	008	009	010	012	016	027
2000	7000	210	001	003	003	005	005	007	010	015	024
4000	7000	211	002	005	007	008	009	010	014	018	034
8000	7000	212	003	007	008	010	011	012	014	024	034

27 JUNE 68 CONTINUED

POSITION IN CENTIMETERS			STATION	CONE	INDEX	READINGS AT DEPTHS IN CENTIMETERS						
X	Y	NO.		0.0	2.5	5.0	7.5	10.0	12.5	15.0	22.5	30.0
10000	7000	213		004	013	014	014	014	014	016	030	047
12000	7000	214		002	004	007	003	010	011	012	016	030
14000	7000	215		002	006	007	003	009	010	013	020	032
22000	7000	216		002	008	009	011	012	012	015	022	030
22000	7500	217		003	005	006	008	010	012	014	020	030
14000	7500	218		002	007	008	003	010	012	015	026	038
12000	7500	219		002	004	006	003	009	010	010	013	022
10000	7500	220		004	008	009	010	010	011	012	019	026
8000	7500	221		005	008	012	012	013	014	015	024	044
4000	7500	222		002	005	007	003	009	010	012	019	032
2000	7500	223		002	006	007	003	008	010	012	016	030
0000	7500	224		003	007	009	010	011	012	014	024	040
0000	7900	225		007	010	011	011	011	011	012	020	036
2000	7900	226		002	006	008	003	009	010	012	016	026
4000	7900	227		006	010	012	012	012	012	015	028	040
8000	7900	228		005	011	014	015	016	017	017	022	036
10000	7900	229		002	005	006	007	009	010	012	017	028
12000	7900	230		005	010	012	012	013	014	015	024	040
14000	7900	231		007	010	013	014	014	014	015	025	046
22000	7900	232		002	005	007	003	009	010	014	020	030
22000	8300	233		003	005	007	008	009	011	013	022	038
14000	8300	234		003	007	008	010	011	011	012	020	030
12000	8300	235		001	003	005	007	009	010	012	016	026
10000	8300	236		002	004	005	008	010	012	015	020	032
8000	8300	237		003	008	009	010	011	013	014	020	037
4000	8300	238		004	006	009	010	011	011	012	020	038
2000	8300	239		002	006	008	010	011	012	013	019	048
0000	8300	240		006	012	014	014	014	014	014	028	054
0000	8700	241		008	012	012	014	014	014	020	042	100
2000	8700	242		005	013	015	015	016	016	016	030	056
4000	8700	243		007	014	014	014	014	014	015	027	050
8000	8700	244		006	008	011	012	012	012	013	022	032
10000	8700	245		002	004	005	006	008	009	010	015	030
12000	8700	246		002	006	007	008	008	010	012	018	028
14000	8700	247		003	007	008	008	008	010	012	019	030
22000	8700	248		003	006	008	009	010	012	014	019	034
7500	3500	249		004	012	015	016	017	018	019	100	100
8400	3000	250		003	010	016	021	026	026	026	028	100
9400	3500	251		003	006	010	012	014	016	018	100	100
8400	4000	252		002	010	014	017	018	020	022	100	100
10700	4500	253		002	009	015	020	023	026	027	027	100
11600	4000	254		004	008	015	018	018	018	100	100	100
12500	4500	255		005	013	017	018	018	019	019	100	100
AVERAGE CI AT EACH DEPTH				003	007	009	012	012	012	016	027	042

PENETROMETER DATA

29 JUNE 68 RANGE 76 LINE NO. 203

DATA COLLECTED FROM STATION NO. 256-271, 0810 TO 0825 HRS
STATION NO. 272, 1316 HRS

PENETROMETER WITH 0-100 DIAL GAGE AND 3.22 SQ CM CONE

POSITION IN CENTIMETERS		STATION	CONE INDEX	READINGS	AT DEPTHS	IN CENTIMETERS					
X	Y	NO.	0.0	2.5	5.0	7.5	10.0	12.5	15.0	22.5	30.0
0100	0200	256	002	004	004	005	006	012	027	038	038
0700	0200	257	003	010	015	015	016	017	017	021	024
1300	0200	258	002	006	010	014	018	024	032	042	043
0100	0400	259	003	008	013	015	015	016	017	026	038
0700	0400	260	003	014	020	027	032	034	034	037	042
1300	0400	261	002	005	009	015	024	030	040	058	056
0100	0600	262	002	007	016	027	030	032	033	036	036
1300	0600	263	001	003	010	020	023	025	025	042	062
1300	0900	264	002	004	009	017	022	024	026	025	026
1300	1000	265	001	003	004	005	009	015	025	025	025
1300	1200	266	002	007	021	030	033	039	043	046	053
1300	1400	267	002	005	015	021	027	029	029	029	029
0100	0800	268	001	002	006	014	020	025	026	026	026
0100	1000	269	002	005	012	017	020	021	021	021	021
0100	1200	270	003	010	023	030	042	050	055	072	100
0100	1400	271	007	014	020	030	037	037	040	068	100
0800	0300	272	002	006	016	030	045	051	060	087	100
AVERAGE CI AT EACH DEPTH			002	007	013	020	025	028	032	041	046

PENETROMETER DATA

30 JUNE 68 RANGE 76 LINE NO. 138

DATA COLLECTED FROM STATION NO. 273-290, 0816 TO 0843 HRS
STATION NO. 291-300, 1114 TO 1123 HRS
STATION NO. 301, 1553 HRS

PENETROMETER WITH 0-100 DIAL GAGE AND 3.22 SQ CM CONE

POSITION IN CENTIMETERS		STATION	CONE INDEX	READINGS	AT DEPTHS	IN CENTIMETERS					
X	Y	NO.	0.0	2.5	5.0	7.5	10.0	12.5	15.0	22.5	30.0
0200	0200	273	001	004	010	014	016	018	022	024	025
0400	0200	274	001	006	012	014	015	016	017	018	024
0600	0200	275	001	006	009	011	013	015	017	030	048
0800	0200	276	001	004	007	014	018	022	022	050	056
1000	0200	277	002	006	012	016	016	018	019	060	079
1200	0200	278	001	005	012	015	025	034	043	060	078
1400	0200	279	001	005	016	023	026	033	035	041	042
0200	0400	280	001	008	013	017	018	018	019	020	039
0400	0400	281	003	008	012	014	017	019	020	025	030
0600	0400	282	003	010	015	019	027	033	037	049	054
0800	0400	283	002	004	006	023	032	042	048	075	068
1000	0400	284	002	006	012	015	029	034	044	073	084
1200	0400	285	002	005	016	025	033	044	052	055	059
1400	0400	286	002	007	013	022	028	036	046	067	067
0200	0600	287	002	009	019	027	030	034	036	042	042
0200	0800	288	002	005	013	025	030	030	030	030	030
1400	0600	289	001	008	016	020	026	030	032	058	074
1400	0800	290	002	010	019	024	027	029	030	030	030
0800	0400	291	002	010	018	030	040	050	060	082	100
1000	0400	292	002	004	010	024	036	052	062	090	100
1200	0400	293	004	007	014	020	025	025	025	030	030
1400	0400	294	002	006	014	020	024	029	045	062	062
1400	0600	295	003	007	009	015	022	025	060	070	070
1200	0600	296	003	006	010	012	020	026	030	048	065
1000	0600	297	003	003	010	015	016	040	050	080	080
0800	0600	298	004	009	016	023	031	040	057	059	059
1400	0800	299	001	007	016	028	037	041	041	041	041
1400	1000	300	003	008	015	021	026	028	029	029	029
0800	0700	301	002	007	012	020	026	034	040	050	050
AVERAGE CI AT EACH DEPTH			002	007	013	020	025	031	037	050	056

PENETROMETER DATA

5 JULY 58 RANGE 76 LINE NO. 68
 DATA COLLECTED FROM STATION NO. 302-305, 0956 TC 1003 HRS
 STATION NO. 306-310, 0925 TO 0937 HRS
 STATION NO. 311-316, 1325 TO 1329 HRS
 STATION NO. 317-321, 1415 TO 1422 HRS
 STATION NO. 322-326, 1505 TC 1509 HRS

PENETROMETER WITH 0-100 JIAL GAGE AND 3.22 SQ CM CONE
 POSITION IN CENTIMETERS STATION CONE INDEX READINGS AT DEPTHS IN CENTIMETERS

X	Y	NO.	0.0	2.5	5.0	7.5	10.0	12.5	15.0	22.5	30.0
0150	0150	302	001	001	004	025	034	042	049	049	050
0250	0150	303	001	003	005	013	019	021	024	026	034
0150	0050	304	001	004	024	037	044	046	046	046	046
0050	0150	305	001	003	018	031	036	038	038	038	038
0150	0250	306	001	004	016	025	029	030	032	032	032
0150	0150	307	001	005	008	013	018	022	025	030	036
0250	0150	308	002	012	020	026	030	034	038	037	037
0150	0050	309	001	010	018	033	038	042	045	045	045
0050	0150	310	002	002	016	022	026	028	029	034	036
0150	0250	311	002	008	018	024	026	030	034	040	046
0150	0150	312	001	003	005	010	019	021	021	021	021
0250	0150	313	001	006	013	023	030	036	040	042	048
0150	0050	314	001	005	008	013	035	046	050	055	057
0050	0150	315	002	003	004	009	027	043	048	053	053
0150	0250	316	001	005	018	035	048	053	055	063	072
0150	0150	317	001	003	005	013	028	031	032	032	032
0250	0150	318	002	004	005	012	026	037	045	066	060
0150	0050	319	001	007	016	034	047	054	059	070	075
0050	0150	320	001	005	009	024	039	052	058	070	075
0150	0250	321	001	004	016	029	044	065	076	093	096
0150	0150	322	001	002	003	007	015	020	025	025	025
0250	0150	323	001	003	010	025	035	043	050	062	076
0150	0050	324	001	005	010	022	032	034	034	040	070
0050	0150	325	001	004	007	022	035	045	051	059	080
0150	0250	326	001	004	007	015	044	061	070	076	088
AVERAGE CI AT EACH DEPTH			001	005	011	022	032	039	043	048	053

PENETROMETER DATA

11 JULY 58 RANGE 72 LINE NO. 223

DATA COLLECTED FROM STATION NO. 327-374, 1208 TO 1255 HRS

PENETROMETER WITH 0-100 DIAL GAGE AND 3.22 SQ CM CONE

POSITION IN CENTIMETERS	STATION	CONE INDEX	READINGS AT DEPTHS	IN CENTIMETERS
X	Y	NO.	0.0 2.5 5.0 7.5 10.5 12.5	15.5 22.5 30.0
3200	6600	327	006 008 008 009 010 012	014 017 100
3600	6600	328	004 006 007 009 010 011	014 016 100
4600	6600	329	007 009 009 009 010 013	016 020 100
5200	6600	330	006 009 009 010 010 012	015 028 075
5800	6600	331	009 010 010 011 012 014	016 025 100
6400	6600	332	006 012 013 013 013 015	017 025 060
7000	6600	333	006 012 013 013 013 013	015 024 100
7300	6600	334	007 011 012 013 013 015	018 025 100
7300	7000	335	007 012 014 015 015 016	016 024 047
7000	7000	336	006 010 012 012 013 013	015 022 047
6400	7000	337	007 011 013 013 014 015	015 024 085
5800	7000	338	007 010 011 011 011 012	015 020 090
5200	7000	339	005 008 009 009 009 010	012 019 036
4600	7000	340	005 008 005 008 009 011	014 019 070
3800	7000	341	005 007 008 008 008 010	014 015 043
3200	7000	342	006 009 009 010 010 011	013 019 062
3200	7400	343	006 008 009 009 009 010	013 017 029
3800	7400	344	005 007 008 009 010 011	013 016 053
4600	7400	345	005 007 008 009 010 011	013 015 045
5200	7400	346	005 009 009 009 010 011	013 015 034
5400	7400	347	005 009 009 009 010 011	014 021 037
6400	7400	348	005 009 009 010 011 012	014 020 046
7000	7400	349	004 007 009 010 011 013	017 021 034
7300	7400	350	005 010 010 010 011 013	015 021 043
7300	7800	351	004 009 010 010 010 010	012 016 054
7000	7800	352	003 007 011 011 011 011	011 014 027
6400	7800	353	005 007 008 009 009 011	013 017 034
5800	7800	354	007 011 011 012 013 013	016 021 042
5200	7800	355	007 010 010 010 010 012	014 020 040
4600	7800	356	008 011 011 011 011 013	015 021 039
3800	7800	357	005 009 010 010 011 013	015 020 050
3200	7800	358	004 010 010 011 011 013	015 020 037
3200	8200	359	005 010 010 010 010 010	013 021 046
3800	8200	360	006 010 010 010 011 013	015 022 047
4600	8200	361	007 012 012 012 012 012	015 021 050
5200	8200	362	006 010 011 011 011 013	015 018 050
5600	8200	363	005 009 010 010 010 012	015 019 050
6400	8200	364	006 009 009 009 010 012	013 017 044
7000	8200	365	004 006 007 008 009 011	013 016 040
7300	8200	366	005 007 008 009 010 012	013 016 070
7300	8600	367	004 014 015 015 015 016	018 028 072
7000	8600	368	010 013 015 015 016 017	018 027 100
6400	8600	369	006 012 015 015 015 016	018 029 095
5800	8600	370	007 011 011 011 012 014	016 025 100
5200	8600	371	005 007 008 009 010 012	013 019 100
4600	8600	372	003 006 008 009 010 011	013 017 054
3800	8600	373	005 007 009 010 011 012	012 015 100
3200	8600	374	005 007 010 011 011 012	013 015 078
AVERAGE DI AT EACH DEPTH		006 009	010 011 011	012 015 024 062

PENETROMETER DATA

25 JULY 68 RANGE 72 LINE NO. 223

DATA COLLECTED FROM STATION NO. 375-424, 0931 TO 1035 HRS

PENETROMETER WITH 0-100 DIAL GAGE AND 3.22 SQ CM CONE

POSITION IN CENTIMETERS STATION	CONE INDEX READINGS AT DEPTHS IN CENTIMETERS
3200 6500	0.0 2.5 5.0 7.5 10.5 12.5 15.5 22.5 30.0 001 003 006 005 006 006 006 006 010 074
4000 6600	001 005 008 009 008 008 008 009 011 100
5700 6600	001 003 005 006 007 007 007 009 013 085
7400 6600	003 006 006 007 009 012 012 017 100
9100 6600	003 005 006 006 009 011 013 017 100
9100 6400	002 010 013 013 013 013 015 015 022 065
7600 6400	006 013 016 015 016 016 017 026 100
5700 6300	005 012 013 013 013 016 016 021 031 070
4000 6800	009 018 018 019 020 023 025 035 100
3200 6300	003 007 008 003 009 011 013 018 077
3200 7000	012 013 013 013 013 014 015 020 097
4000 7000	005 010 012 012 014 016 016 025 100
5700 7000	008 013 013 013 013 014 017 031 100
7400 7000	005 009 010 010 011 014 016 022 100
9100 7000	007 013 013 014 015 018 020 028 100
9100 7200	004 006 008 010 010 012 012 016 100
7400 7200	004 006 008 013 012 014 016 022 100
5700 7200	003 004 007 013 010 012 014 021 064
4000 7200	004 008 008 013 012 015 019 026 100
3200 7200	006 009 010 011 011 012 015 024 100
3200 7400	003 007 008 003 009 010 012 017 100
4000 7400	006 009 010 010 011 013 015 022 100
5700 7400	003 010 012 012 013 015 018 032 100
7400 7400	015 015 015 015 015 015 015 023 100
9100 7400	005 007 008 003 009 011 014 022 100
9100 7600	004 008 008 010 011 012 014 018 082
7400 7600	006 013 013 013 016 016 020 028 100
5700 7600	007 011 012 013 015 017 020 026 090
4000 7600	004 005 007 010 011 011 012 018 090
3200 7600	001 005 007 007 007 008 006 014 100
3200 7800	005 010 010 010 012 014 015 024 100
4000 7800	010 011 012 012 012 015 018 026 100
5700 7800	009 015 015 015 015 017 021 030 100
7400 7800	007 011 013 014 015 016 020 028 053
9100 7800	006 010 012 012 012 014 018 034 100
9100 8000	005 008 011 013 014 016 018 023 085
7400 8000	004 010 012 014 017 018 016 027 100
5700 8000	005 008 010 011 011 012 014 018 100
4000 8000	005 007 009 011 012 012 013 019 088
3200 8000	003 005 008 010 012 012 016 020 100
3200 8200	007 013 013 013 013 014 016 022 100
4000 8200	011 012 012 012 014 017 021 033 100
5700 8200	005 007 009 010 012 012 012 025 100
7400 8200	006 011 012 013 016 018 023 035 100
9100 8200	005 014 014 014 014 015 019 028 100
9100 8400	010 012 013 013 013 015 017 020 100
7400 8400	021 013 013 014 016 020 021 050 100
5700 8400	010 012 012 012 015 015 018 040 100
4000 8400	008 011 011 011 013 015 020 034 100
3200 8400	006 011 012 012 014 017 027 050 100
AVERAGE CI AT EACH DEPTH	006 009 011 011 012 014 017 025 095

PENETROMETER DATA

31 JULY 58 PANGE T2 LINE NO. 223
 DATA COLLECTED FROM STATION NO. 425-460, 1535 TO 1610 HRS
 PENETROMETER WITH 0-100 DIAL GAGE AND 3.22 SQ CM CONE

X	Y	NO.	CONE	INDEX	READINGS AT DEPTHS IN CENTIMETERS
3200	6400	425	001	002	003 004 005 006 008 010 026
3800	6400	426	001	002	004 005 006 008 010 018
4400	6400	427	002	003	004 005 006 008 010 012 016
5000	6400	428	001	002	004 005 006 008 006 008 015
5600	6400	429	002	003	004 006 006 008 009 015 024
6200	6400	430	002	003	005 006 008 009 011 014 022
6200	6800	431	002	004	005 008 008 008 010 012 013 036
5600	6800	432	006	008	008 008 009 010 012 014 024
5000	6800	433	003	005	007 005 009 010 012 021 070
4400	6800	434	003	006	008 005 009 010 012 018 024
3800	6800	435	003	005	006 008 008 009 010 015 050
3200	6900	436	003	005	006 009 008 010 011 012 028
3200	7200	437	001	002	003 004 005 006 008 011
3800	7200	438	002	004	006 008 008 009 011 015 020
4400	7200	439	002	004	006 008 009 010 012 014 018
5000	7200	440	002	004	005 009 010 011 013 021
5600	7200	441	002	003	004 006 008 009 010 012 016
6200	7200	442	002	004	005 006 008 010 011 015 021
6200	7600	443	003	004	004 005 006 008 010 011 016
5600	7600	444	002	003	003 004 005 008 008 014 030
5000	7600	445	002	003	004 005 008 008 010 012 020
4400	7600	446	002	004	006 003 009 010 010 014 100
3800	7600	447	003	006	006 006 008 010 011 018 090
3200	7600	448	002	009	009 009 009 010 011 026 090
3200	7600	449	002	003	006 009 009 010 010 018 020
3800	7600	450	002	003	005 006 008 009 010 014 020
4400	7600	451	002	003	004 005 009 010 012 014 022
5000	7600	452	002	004	006 005 010 011 012 014 020
5600	7600	453	002	004	005 006 009 010 012 016 022
6200	7600	454	002	004	005 008 009 010 011 014 016
6200	8400	455	002	004	005 006 008 010 012 015 070
5600	8400	456	002	004	006 006 008 009 011 015 070
5000	8400	457	002	004	006 009 012 014 016 020 090
4400	8400	458	002	005	009 009 010 011 012 020 030
3800	8400	459	003	005	006 004 009 011 014 018 038
3200	8400	460	003	005	006 003 009 011 012 018 080
AVERAGE CI AT EACH DEPTH			004	006	007 007 008 010 011 016 036

PENETROMETER DATA

1 AUG 69 RANGE 72 LINE NO. 223
 DATA COLLECTED FROM STATION NO. 461-496, 0950 TO 1025 HRS
 STATION NO. 497-508, 1139 TO 1150 HRS

PENETROMETER WITH 0-100 DIAL GAGE AND 3.22 SO CM CONE

POSITION IN CENTIMETERS	STATION	CONE INDEX	READINGS AT DEPTHS IN CENTIMETERS
X	Y	NO.	0.0 2.5 5.0 7.5 10.0 12.5 15.5 22.5 30.0
3200	6400	461	001 003 004 006 005 006 009 012 020
3800	6400	462	001 002 003 004 006 008 009 012 022
4400	6400	463	001 002 004 009 012 015 018 019 022
5000	6400	464	002 003 005 008 010 012 012 014 024
5600	6400	465	002 004 005 009 010 012 012 014 024
6200	6400	466	002 004 006 008 010 012 012 014 024
6200	6800	467	006 013 014 014 014 014 014 018 040
5600	6800	468	008 010 012 013 013 014 015 022 042
5000	6800	469	006 010 013 013 013 013 014 020 048
4400	6800	470	004 007 008 009 010 012 012 018 028
3800	6800	471	005 008 010 010 010 012 012 021 036
3200	6800	472	004 009 010 011 011 011 012 018 031
3200	7200	473	003 008 010 010 010 012 014 021 032
3800	7200	474	005 008 011 012 012 013 015 024 038
4400	7200	475	004 008 009 010 010 012 015 024 044
5000	7200	476	003 005 010 012 012 013 014 016 046
5600	7200	477	003 008 010 011 011 012 013 022 039
6200	7200	478	003 008 010 012 012 012 015 022 036
6200	7600	479	002 004 005 007 009 011 012 014 019
5600	7600	480	003 005 006 008 008 009 011 015 021
5000	7600	481	001 003 004 006 006 010 012 014 016
4400	7600	482	002 005 006 007 008 009 010 011 016
3800	7600	483	002 005 006 009 008 009 010 011 020
3200	7600	484	001 003 004 006 008 010 012 014 016
3200	8000	485	002 006 008 010 012 012 014 021 034
3800	8000	486	003 005 010 012 012 014 018 022 035
4400	8000	487	003 008 010 012 012 014 015 024 036
5000	8000	488	003 008 010 012 014 015 016 022 038
5600	8000	489	003 008 009 010 011 012 014 021 038
6200	8000	490	002 005 008 010 011 012 014 022 030
6200	8400	491	002 003 005 006 008 009 011 014 026
5600	8400	492	002 004 005 009 009 010 012 014 025
5000	8400	493	002 004 008 010 011 013 015 022 032
4400	8400	494	003 005 007 009 010 011 013 019 028
3800	8400	495	004 008 009 009 010 011 013 018 024
3200	8400	496	004 008 010 010 011 012 014 021 031
3200	5200	497	003 006 008 003 008 010 012 020 035
3800	5200	498	004 010 011 012 012 013 015 018 032
4400	5200	499	004 006 008 010 011 012 015 015 032
5000	5200	500	003 005 009 011 012 014 020 025 042
5600	5200	501	004 009 010 012 012 013 014 021 042
6200	5200	502	004 011 012 014 015 020 024 038 095
6200	5600	503	006 009 012 014 014 015 020 028 060
5600	5600	504	004 008 011 012 013 014 016 028 042
5000	5600	505	001 004 008 010 014 015 015 020 038
4400	5600	506	002 004 008 010 012 014 015 021 060
3800	5600	507	002 006 009 013 012 014 016 022 060
3200	5600	508	004 005 010 014 018 022 024 030 092
AVERAGE CI AT EACH DEPTH		003 006 008	010 011 012 014 020 036

PENETROMETER DATA

5 NOV 68 RANGE 72 LINE NO. 223

DATA COLLECTED FROM STATION NO. 509-580, 1119 TO 1230 HRS

PENETROMETER WITH 0-100 DIAL GAGE AND 3.22 SQ CM CONE

POSITION IN CENTIMETERS STATION CONE INDEX READINGS AT DEPTHS IN CENTIMETERS

X	Y	NO.	0.0	2.5	5.0	7.5	10.0	12.5	15.5	22.5	30.0
2900	5000	509	002	007	009	010	013	019	025	032	076
3400	6600	510	004	009	010	012	015	018	023	033	080
3900	6600	511	004	008	009	010	013	016	023	032	090
4400	6600	512	003	005	008	009	011	017	020	030	080
4900	6600	513	004	006	008	010	012	014	022	032	064
5400	6600	514	003	005	007	009	010	016	021	027	072
5400	6900	515	005	009	011	012	013	017	021	035	096
4900	6900	516	006	010	011	012	013	015	018	039	076
4400	6900	517	006	009	011	012	014	019	024	036	074
3900	6900	518	005	010	011	013	016	020	025	039	080
3400	6900	519	005	008	009	010	012	014	019	030	072
2900	6900	520	005	008	009	010	010	013	016	026	062
2900	7200	521	001	003	005	007	009	012	015	020	030
3400	7200	522	002	005	006	009	010	013	015	022	036
3900	7200	523	002	004	005	006	008	011	013	020	026
4400	7200	524	001	003	005	008	010	012	012	012	026
4900	7200	525	001	003	005	007	009	011	012	017	100
5400	7200	526	002	005	007	010	015	022	026	044	100
5400	7500	527	004	007	008	009	010	013	017	025	066
4900	7500	528	003	005	006	007	009	011	014	022	042
4400	7500	529	002	003	005	007	009	011	013	020	035
3900	7500	530	003	006	007	008	009	011	014	022	046
3400	7500	531	003	005	007	009	009	011	015	024	040
2900	7500	532	002	003	006	007	009	012	015	020	052
2900	7800	533	003	005	009	010	011	012	020	030	082
3400	7800	534	003	005	008	009	010	010	013	025	037
3900	7800	535	001	002	004	006	006	008	010	013	072
4400	7800	536	002	004	005	006	007	008	013	022	080
4900	7800	537	004	008	009	010	011	013	016	032	080
5400	7800	538	002	003	005	006	009	011	013	022	034
5400	8100	539	002	004	004	005	006	008	009	014	024
4900	8100	540	004	008	009	009	010	013	018	034	048
4400	8100	541	005	009	010	011	013	015	019	039	100
3900	8100	542	003	006	008	009	010	012	015	024	074
3400	8100	543	004	005	008	003	010	013	017	025	086
2900	8100	544	004	007	009	009	009	012	014	023	066
2900	8400	545	003	003	009	010	012	014	019	030	100
3400	8400	546	006	010	011	012	014	019	024	048	100
3900	8400	547	005	010	011	013	016	023	029	044	100
4400	8400	548	003	005	007	008	009	011	018	024	066
4900	8400	549	004	008	010	011	012	016	020	029	080
5400	8400	550	003	005	009	010	011	015	020	030	072
5400	8700	551	004	008	010	012	015	020	025	039	100
4900	8700	552	006	010	011	013	014	018	025	050	100
4400	8700	553	003	009	012	015	020	024	028	048	100
3900	8700	554	004	009	010	012	015	020	027	044	100
3400	8700	555	003	007	009	011	013	018	025	038	100
2900	8700	556	005	010	011	012	014	017	022	036	100
2900	9000	557	003	005	007	008	009	011	013	023	082
3400	9000	558	004	005	007	008	009	012	015	027	076
3900	9000	559	003	007	008	009	009	012	017	028	092
4400	9000	560	005	007	009	009	010	012	015	028	072
4900	9000	561	003	008	009	010	010	012	015	024	070
5400	9000	562	005	008	010	010	011	012	016	030	082

5 NOV 63 CONTINUED

POSITION IN CENTIMETERS			STATION	CONE	INDEX	READINGS	AT DEPTHS	IN CENTIMETERS				
X	Y	NO.		0.0	2.5	5.0	7.5	10.0	12.5	15.0	22.5	30.0
5400	9300	563		004	009	010	013	015	020	027	052	100
4900	9300	564		004	008	010	011	013	017	022	042	100
4400	9300	565		003	008	010	011	013	017	019	044	076
3900	9300	566		005	009	009	010	012	015	022	040	080
3400	9300	567		003	007	009	011	013	017	023	037	077
2900	9300	568		003	007	009	011	012	016	021	040	080
2900	9600	569		005	009	010	010	012	015	020	030	076
3400	9600	570		003	009	010	011	012	014	018	027	082
3900	9600	571		003	008	009	009	010	013	017	030	076
4400	9600	572		004	008	009	009	010	013	017	028	060
4900	9600	573		004	008	009	010	011	014	016	029	070
5400	9600	574		005	008	008	010	011	014	019	030	070
5400	9900	575		001	003	005	007	009	012	015	021	100
4900	9900	576		003	005	007	007	009	012	014	028	072
4400	9900	577		002	003	004	006	008	012	014	023	090
3900	9900	578		002	004	005	005	009	012	014	021	054
3400	9900	579		001	003	004	005	008	011	014	019	046
2900	9900	580		001	001	002	003	005	007	009	012	070
AVERAGE CI AT EACH DEPTH				003	007	008	009	011	014	018	030	073

PENETROMETER DATA

14 NOV 63 RANGE 72 LINE NO. 223

DATA COLLECTED FROM STATION NO. 581-589, 1202 TO 1210 HRS

PENETROMETER WITH 0-100 DIAL GAGE AND 3.22 SQ CM CONE

POSITION IN CENTIMETERS			STATION	CONE	INDEX	READINGS	AT DEPTHS	IN CENTIMETERS				
X	Y	NO.		0.0	2.5	5.0	7.5	10.0	12.5	15.5	22.5	30.0
4400	6600	581		004	008	010	010	012	014	022	032	040
4900	6600	582		004	009	010	011	014	018	022	028	036
5400	6600	583		004	007	008	010	012	015	019	027	034
5400	6900	584		006	014	014	014	015	019	024	034	058
4900	6900	585		004	011	014	016	019	023	026	033	050
4400	6900	586		006	009	010	011	013	019	022	026	042
4400	7200	587		003	004	008	01*	012	016	016	023	026
4900	7200	588		002	004	006	009	010	013	015	020	023
5400	7200	589		002	003	008	011	012	013	015	019	022
AVERAGE CI AT EACH DEPTH				004	008	011	012	013	017	020	027	037

PENETROMETER DATA

21 NOV 64 RANGE 72 LINE NO. 223

DATA COLLECTED FROM STATION NO. 590-661, 1335 TC 1445 HRS

PENETROMETER WITH 0-100 DIAL GAGE AND 3.22 SQ CM CONE

POSITION IN CENTIMETERS	STATION	CONE INDEX	READINGS AT DEPTHS	IN CENTIMETERS
X	Y	NO.	6.0 2.5 5.0 7.5 10.5 12.5 15.5 22.5	39.0
2900	6500	590	001 003 005 005 007 008 009 014 038	
3400	6500	591	006 008 008 009 010 010 012 020 043	
3900	6500	592	004 006 007 007 007 008 009 014 034	
4400	6540	593	002 004 004 005 005 006 007 015 050	
4900	6600	594	001 002 002 003 004 004 005 012 026	
5400	6600	595	001 002 003 004 004 005 005 010 024	
5400	6930	596	004 007 009 013 011 012 015 020 082	
4900	6900	597	003 005 008 010 011 012 014 020 076	
4400	6300	598	004 006 007 009 010 011 012 024 078	
3900	6900	599	006 011 012 013 014 015 017 040 078	
3400	6900	600	011 019 025 028 028 028 030 050 072	
2900	6300	601	008 012 013 016 022 025 030 046 030	
2900	7200	602	002 003 004 004 004 005 006 012 024	
3400	7200	603	001 004 004 004 004 007 010 014 025	
3900	7200	604	002 004 004 004 004 004 006 012 025	
4400	7200	605	001 004 004 004 004 004 005 011 022	
4900	7200	606	003 005 008 010 010 010 010 016 025	
5400	7200	607	002 007 009 010 010 012 012 016 025	
5400	7500	608	005 007 009 009 011 013 015 020 029	
4900	7500	609	006 010 011 012 012 012 015 023 037	
4400	7500	610	006 007 009 010 011 012 015 022 030	
3900	7500	611	005 007 008 009 010 014 014 018 024	
3400	7500	612	003 007 009 010 012 013 015 024 032	
2900	7500	613	005 008 008 009 010 013 017 023 032	
2900	7800	614	005 012 014 015 016 018 023 043 054	
3400	7800	615	006 011 013 015 016 017 020 032 051	
3900	7800	616	004 010 012 015 016 020 024 028 032	
4400	7800	617	008 012 012 013 014 017 020 032 045	
4900	7800	618	006 013 014 014 015 016 019 032 044	
5400	7800	619	007 010 012 013 013 015 019 027 042	
5400	8100	620	001 002 005 007 007 008 010 014 022	
4900	8100	621	002 004 005 007 009 012 013 015 025	
4400	8100	622	004 006 009 010 011 014 015 022 029	
3900	8100	623	002 003 004 006 008 009 010 013 022	
3400	8100	624	003 004 005 006 008 010 012 016 021	
2900	8100	625	005 008 008 009 010 012 014 019 026	
2900	8400	626	008 011 011 012 013 015 018 027 042	
3400	8400	627	014 016 016 017 018 021 026 042 062	
3900	8400	628	014 018 018 020 022 027 036 053 070	
4400	8400	629	017 022 022 022 022 023 030 049 070	
4900	8400	630	016 020 020 020 020 022 027 041 058	
5400	8400	631	016 019 019 020 020 020 020 035 045	
5400	8700	632	006 010 010 012 013 015 020 026 035	
4900	8700	633	006 011 011 012 013 016 019 028 039	
4400	8700	634	006 012 014 015 019 024 027 038 046	
3900	8700	635	009 012 014 014 016 020 023 031 048	
3400	8700	636	010 013 014 014 015 018 022 036 050	
2900	8700	637	006 012 012 013 014 017 020 027 039	
2900	9000	638	001 002 003 005 006 006 007 012 021	
3400	9000	639	004 007 007 007 003 010 012 016 026	
3900	9000	640	003 006 006 008 009 010 011 017 023	
4400	9000	641	003 005 006 008 009 012 013 019 026	
4900	9000	642	003 007 009 010 011 012 013 018 029	
5400	9000	643	004 006 007 009 010 010 012 018 026	

21 NOV 63 CONTINUED

POSITION IN CENTIMETERS			STATION	CONE	INDEX	READINGS	AT DEPTHS	IN CENTIMETERS				
X	Y	NO.		0.0	2.5	5.0	7.5	10.0	12.5	15.0	22.5	30.0
5400	9300	644		003	006	007	007	008	010	014	019	030
4900	9300	645		003	006	008	009	010	012	012	020	025
4400	9300	646		004	007	008	010	011	012	012	014	025
3900	9300	647		002	005	006	007	008	010	010	015	025
3400	9300	648		003	006	007	008	010	011	012	017	024
2900	9300	649		005	009	010	010	012	014	024	032	040
2900	9600	650		003	005	005	006	007	008	010	016	027
3400	9600	651		004	007	008	009	010	011	013	018	029
3900	9600	652		006	011	012	013	014	015	018	028	040
4400	9600	653		006	010	010	012	013	014	016	024	034
4900	9600	654		003	007	008	009	010	012	014	020	026
5400	9600	655		004	007	008	010	012	013	014	019	025
5400	9900	656		004	007	008	010	012	013	013	017	026
4900	9900	657		003	007	008	009	010	012	014	019	027
4400	9900	658		007	009	010	010	012	013	015	020	026
3900	9900	659		006	010	011	011	011	012	015	016	033
3400	9900	660		002	004	006	008	009	009	010	014	022
2900	9900	661		004	005	006	009	012	014	014	016	024
AVERAGE CI AT EACH DEPTH				005	008	009	010	012	013	015	023	037

PENETROMETER DATA

26 NOV 63 RANGE 72 LINE NO. 223

DATA COLLECTED FROM 1229 TO 1305 HRS

PENETROMETER WITH 0-100 DIAL GAGE AND 3.22 SQ CM CONE

POSITION IN CENTIMETERS			STATION	CONE	INDEX	READINGS	AT DEPTHS	IN CENTIMETERS				
X	Y	NO.		0.0	2.5	5.0	7.5	10.5	12.5	15.5	22.5	30.0
2600	6000	662		006	009	010	011	012	013	014	020	034
2900	6600	663		006	009	010	011	014	016	019	026	043
3400	6630	664		005	008	009	010	012	015	016	022	029
3900	6600	665		003	006	007	010	011	012	013	021	027
4400	6600	666		004	007	009	010	012	014	015	022	039
4900	6600	667		006	009	009	010	012	014	017	023	035
5400	6600	668		007	012	013	015	019	022	027	042	056
5700	5600	669		009	013	014	016	017	020	024	040	062
5700	6900	670		010	012	013	014	016	019	025	046	060
5400	6900	671		009	013	015	017	020	023	028	046	060
4900	6900	672		007	012	013	015	017	020	025	036	043
4400	6900	673		006	011	012	014	018	022	026	032	052
3900	6900	674		006	009	010	012	016	019	023	027	037
3400	6900	675		004	009	011	013	016	019	023	028	039
2900	6900	676		004	008	009	012	013	014	017	028	043
2600	6900	677		008	011	012	012	014	016	020	033	041
2600	7200	678		007	011	012	014	016	019	023	032	051
2900	7200	679		006	010	011	013	015	017	020	026	042
3400	7200	680		006	009	009	010	012	013	016	023	042
3900	7200	681		006	011	012	014	016	018	022	033	056
4400	7200	682		006	010	010	011	012	014	018	027	036
4900	7200	683		008	012	012	012	015	015	016	025	048
5400	7200	684		008	013	013	014	015	020	026	035	048
5700	7200	685		007	010	010	012	013	016	018	027	056
5700	7500	686		010	014	015	018	020	022	027	038	056
5400	7500	687		006	011	012	013	014	016	019	030	047
4900	7500	688		008	012	013	014	015	017	021	032	052
4400	7500	689		009	014	016	017	018	018	023	039	052
3900	7500	690		009	012	012	014	016	019	022	034	050
3400	7500	691		009	013	015	015	016	018	022	042	059
2900	7500	692		009	013	013	014	015	017	020	033	100
2600	7500	693		009	014	016	017	019	023	027	044	070
AVERAGE CI AT EACH DEPTH				007	011	012	013	016	018	021	032	059

PENETROMETER DATA

25 FEB 63 RANGE 76 LINE NO. 227

DATA COLLECTED FROM 0925 TO 1150 HRS

PENETROMETER WITH 0-100 DIAL GAGE AND 3.22 SQ CM CONE

POSITION IN CENTIMETERS	STATION	CONE INDEX	READINGS AT DEPTHS	IN CENTIMETERS
X	Y	NO.	0.0 2.5 5.0 7.5 10.5 12.5 15.5 22.5 30.0	
0500	0500	694	001 004 015 025 032 033 036 036 070	
0500	0600	695	001 012 030 050 072 082 085 085 085	
0600	0500	696	001 009 030 050 070 080 090 100 130	
0500	0400	697	001 009 036 055 072 084 090 090 090	
0400	0500	698	001 013 032 047 056 061 068 068 068	
0500	0500	699	001 008 013 015 019 022 025 028 028	
0500	0500	700	001 005 011 013 025 035 048 068 090	
0500	0500	701	001 006 009 012 012 012 012 012 012	
0500	0500	702	001 003 006 013 020 022 023 027 060	
AVERAGE CI AT EACH DEPTH		001	008 020 032 042 048 053 057 067	

PENETROMETER DATA

28 FEB 63 RANGE 72 LINE NO. 161/162

DATA COLLECTED FROM 0917 TO 0931 HRS

PENETROMETER WITH 0-100 DIAL GAGE AND 3.22 SQ CM CONE

POSITION IN CENTIMETERS	STATION	CONE INDEX	READINGS AT DEPTHS	IN CENTIMETERS
X	Y	NO.	0.0 2.5 5.0 7.5 10.5 12.5 15.5 22.5 30.0	
8100	2300	703	001 004 007 008 008 008 008 012 021	
8900	2300	704	002 007 009 010 011 014 016 025 034	
8500	2100	705	002 005 006 009 010 011 012 016 027	
8500	2500	706	006 011 012 013 014 016 026 039 056	
8800	2200	707	001 004 008 013 017 019 019 021 024	
9500	2200	708	003 009 012 013 014 015 017 030 038	
9200	2000	709	003 007 011 012 014 015 016 024 040	
9200	2400	710	003 008 009 010 012 014 016 023 034	
AVERAGE CI AT EACH DEPTH		003	007 009 011 013 014 016 024 034	

PENETROMETER DATA

4 MAR 63 RANGE 72 LINE NO. 161/162

DATA COLLECTED FROM 1055 TO 1108 HRS

PENETROMETER WITH 0-100 DIAL GAGE AND 3.22 SQ CM CONE

POSITION IN CENTIMETERS	STATION	CONE INDEX	READINGS AT DEPTHS	IN CENTIMETERS
X	Y	NO.	0.0 2.5 5.0 7.5 10.5 12.5 15.5 22.5 30.0	
5500	5500	711	007 012 013 013 014 017 020 030 048	
5800	5200	712	006 016 017 017 017 017 018 036 052	
6200	5500	713	009 015 016 016 018 018 018 044 054	
5800	5900	714	009 020 020 020 020 020 024 050 064	
4700	6700	715	023 023 023 023 023 023 023 030 048	
5000	6300	716	007 017 017 019 019 019 024 042 064	
5400	6700	717	011 016 016 017 021 026 028 032 054	
5000	7100	718	011 016 018 020 020 020 024 037 061	
AVERAGE CI AT EACH DEPTH		010	017 018 018 019 020 023 038 056	

PENETROMETER DATA

10 MAR 63 RANGE 72 LINE NO. 161/162

DATA COLLECTED FROM 1240 TO 1243 HRS

PENETROMETER WITH 0-100 DIAL GAGE AND 3.22 SQ CM CONE

POSITION IN CENTIMETERS	STATION	CONE INDEX	READINGS AT DEPTHS	IN CENTIMETERS
X	Y	NO.	0.0 2.5 5.0 7.5 10.5 12.5 15.5 22.5 30.0	
2400	8200	719	005 008 011 012 016 020 024 037 090	
3000	7900	720	002 008 010 013 019 023 027 042 078	
3300	8200	721	003 009 011 013 015 017 020 036 084	
3000	8300	722	005 012 013 015 016 019 025 042 054	
AVERAGE CI AT EACH DEPTH		004	009 011 013 017 020 024 039 077	

PENETROMETER DATA

14 MAR 69 RANGE 72 LINE NO. 161/162

DATA COLLECTED FROM STATION NO. 723-742, 1139 TO 1219 HRS
STATION NO. 743-778, 1606 TO 1645 HRS

PENETROMETER WITH 0-100 DIAL GAGE AND 3.22 SQ CM CONE

POSITION IN CENTIMETERS	STATION	CONE INDEX	READINGS AT DEPTHS	IN CENTIMETERS
X	Y	NO.	0.0 2.5 5.0 7.5 10.0 12.5 15.5 22.5 30.0	
1500	2100	723	006 010 011 012 014 016 020 028 044	
1700	1900	724	006 008 009 010 012 014 016 020 044	
1900	2100	725	007 009 010 012 013 014 016 020 048	
1700	2300	726	003 004 004 005 008 010 012 012 034	
10600	3200	727	006 010 011 012 014 015 016 018 048	
10800	3000	728	004 006 008 008 010 012 013 014 026	
11000	3200	729	005 010 012 014 015 016 020 030 051	
10800	3400	730	005 008 012 014 016 020 022 032 050	
11300	3300	731	006 010 011 011 013 015 018 025 038	
11500	3100	732	005 010 011 012 015 020 022 038 052	
11700	3300	733	005 008 009 010 012 017 019 022 038	
11500	3500	734	006 010 013 015 018 020 021 024 050	
0000	3000	735	004 009 009 010 011 012 016 024 048	
8200	3600	736	006 008 010 012 014 020 022 028 042	
8400	3600	737	004 006 008 009 018 015 017 022 038	
6200	4000	738	006 010 011 012 013 016 019 024 054	
10200	4800	739	004 005 006 010 012 018 020 025 032	
10400	4600	740	005 009 009 012 013 015 018 024 042	
10600	4800	741	006 009 010 012 014 016 020 022 036	
10400	5000	742	004 005 006 008 010 014 017 020 030	
9000	2700	743	004 005 007 009 010 015 024 028 038	
9200	2500	744	006 008 009 010 012 014 015 019 034	
9400	2700	745	005 008 010 010 011 012 018 024 048	
9200	2900	746	004 006 009 010 010 012 015 024 034	
12000	3300	747	006 010 014 015 020 024 030 038 180	
12200	3100	748	006 010 012 014 015 018 020 025 044	
12400	3300	749	006 012 014 016 020 024 038 048 069	
12200	3500	750	018 018 018 018 018 018 018 020 050	
10600	4400	751	006 010 011 012 014 016 018 028 042	
10800	4200	752	009 011 012 014 015 018 020 024 035	
11800	4400	753	006 009 010 012 014 015 018 024 032	
10800	4600	754	004 008 010 012 014 018 025 030 042	
5300	4600	755	006 014 014 015 018 022 024 028 058	
5400	3900	756	006 008 010 012 014 022 024 026 038	
5600	4100	757	006 009 012 014 016 018 020 025 052	
5400	4300	758	010 012 014 018 020 022 026 038 060	
6300	5100	759	006 010 014 014 018 020 025 026 036	
6500	4900	760	006 010 012 012 013 014 018 025 038	
6700	5100	761	006 008 010 014 016 020 024 028 032	
6500	5300	762	004 006 008 010 012 014 016 022 036	
11900	4900	763	004 006 008 010 012 014 018 024 036	
12100	4700	764	004 008 010 012 014 018 020 022 052	
12300	4900	765	005 009 010 010 011 012 014 024 042	
12100	5100	766	004 008 010 011 012 014 018 024 048	
5000	6900	767	010 010 012 015 024 028 030 034 046	
5200	6700	768	004 005 005 009 010 010 012 014 028	
5400	6900	769	006 012 014 018 019 024 028 034 048	
5200	7100	770	006 009 012 013 014 018 024 030 050	
5600	8000	771	004 010 011 012 014 016 022 025 048	
5900	7700	772	005 007 009 010 011 015 018 024 040	
6200	8000	773	006 008 010 012 013 016 020 022 042	
5900	8300	774	008 010 011 012 016 020 024 032 060	
11600	7900	775	006 009 010 012 014 016 019 024 040	

14 MAR 69 CONTINUED

POSITION IN CENTIMETERS			STATION	CONE	INDEX	READINGS AT DEPTHS	IN CENTIMETERS					
X	Y	NO.		0.0	2.5	5.0	7.5	10.0	12.5	15.0	22.5	30.0
11800	7700	776		006	008	009	010	015	022	024	030	050
12000	7900	777		004	008	010	012	014	016	018	024	048
11800	8100	778		006	008	010	013	015	018	024	028	050
AVERAGE CI AT EACH DEPTH				007	009	010	013	014	017	020	026	045

PENETROMETER DATA

25 MAR 69 RANGE 72 LINE NO. 161/162

DATA COLLECTED FROM 1405 TO 1503 HRS

PENETROMETER WITH 0-100 DIAL GAGE AND 3.22 SQ CM CONE

POSITION IN CENTIMETERS			STATION	CONE	INDEX	READINGS AT DEPTHS	IN CENTIMETERS					
X	Y	NO.		0.0	2.5	5.0	7.5	10.0	12.5	15.5	22.5	30.0
5900	5100	779		014	014	014	014	015	017	019	025	036
6100	4700	780		003	005	006	007	008	011	013	018	023
6600	5100	781		007	013	014	016	020	023	026	032	040
6100	5300	782		005	010	011	012	014	016	020	032	044
7600	4500	783		007	011	011	012	013	015	018	024	035
7900	4300	784		002	010	010	011	012	014	016	025	035
8300	4500	785		006	013	015	017	018	021	024	033	040
8300	5100	786		008	014	017	021	026	028	029	032	042
7900	5500	787		008	013	016	023	027	028	030	034	038
7600	5100	788		011	012	013	015	018	022	024	031	044
9600	3500	789		013	015	015	015	015	022	027	038	053
9900	2900	790		009	011	011	012	013	014	016	028	031
10500	3300	791		009	011	012	013	015	018	020	022	030
9900	3900	792		006	012	015	018	020	024	031	040	062
12200	3500	793		015	015	015	015	018	021	023	026	037
12500	3100	794		008	010	011	011	011	013	014	022	028
12900	3500	795		008	009	010	012	014	015	016	023	033
12500	3900	796		015	017	017	017	017	018	022	024	033
11900	6300	797		011	015	015	018	020	022	025	030	038
12100	5900	798		014	018	018	019	020	024	026	039	050
12600	6300	799		011	020	020	020	020	021	023	030	035
12100	6700	800		004	011	014	017	020	024	026	039	050
AVERAGE CI AT EACH DEPTH				009	013	014	015	017	020	022	029	039

PENETROMETER DATA

28 MAR 69 RANGE 72 LINE NO. 161/162

DATA COLLECTED FROM 1732 TO 1736 HRS

PENETROMETER WITH 0-100 DIAL GAGE AND 3.22 SQ CM CONE

POSITION IN CENTIMETERS			STATION	CONE	INDEX	READINGS AT DEPTHS	IN CENTIMETERS					
X	Y	NO.		0.0	2.5	5.0	7.5	10.0	12.5	15.5	22.5	30.0
11200	3900	801		023	023	023	023	023	025	054	100	
11500	3600	802		010	014	015	016	018	020	022	038	100
12100	3900	803		007	009	010	010	010	010	011	050	100
11500	4200	804		007	015	015	015	015	019	023	032	098
AVERAGE CI AT EACH DEPTH				012	015	016	016	017	018	020	044	100

PENETROMETER DATA

2 APR 69 RANGE 72 LINE NO. 161/162

DATA COLLECTED FROM 1158 TO 1204 HRS

PENETROMETER WITH 0-100 DIAL GAGE AND 3.22 SQ CM CONE

POSITION IN CENTIMETERS		STATION	CONE INDEX	READINGS	AT DEPTHS	IN CENTIMETERS					
X	Y	NO.	0.0	2.5	5.0	7.5	10.0	12.5	15.5	22.5	30.0
7400	8300	805	006	006	006	006	008	012	012	016	048
7700	7800	806	002	004	006	006	008	012	016	020	034
8300	8300	807	004	008	008	008	014	016	020	022	052
7700	8700	808	006	006	006	008	008	010	012	022	040
AVERAGE CI AT EACH DEPTH			005	006	007	007	010	013	015	020	044

PENETROMETER DATA

23 APR 69 RANGE 72 LINE NO. 161/162

DATA COLLECTED FROM 1200 TO 1203 HRS

PENETROMETER WITH 0-100 DIAL GAGE AND 3.22 SQ CM CONE

POSITION IN CENTIMETERS		STATION	CONE INDEX	READINGS	AT DEPTHS	IN CENTIMETERS					
X	Y	NO.	0.0	2.5	5.0	7.5	10.0	12.5	15.5	22.5	30.0
2300	5100	809	002	004	008	010	014	018	022	026	100
2500	4900	810	008	012	012	012	012	014	018	028	100
2700	5100	811	002	004	006	008	010	010	014	026	064
2500	5300	812	001	004	006	008	010	012	014	022	100
AVFRAGE CI AT EACH DEPTH			003	006	008	010	011	014	017	026	091

PENETROMETER DATA

25 APR 69 RANGE 72 LINE NO. 161/162

DATA COLLECTED FROM STATION NO. 813-823, 1757 TO 1826 HRS

STATION NO. 824-840, 1413 TO 1453 HRS

PENETROMETER WITH 0-100 DIAL GAGE AND 3.22 SQ CM CONE

POSITION IN CENTIMETERS		STATION	CONE INDEX	READINGS	AT DEPTHS	IN CENTIMETERS					
X	Y	NO.	0.0	2.5	5.0	7.5	10.0	12.5	15.5	22.5	30.0
13900	4000	813	005	008	009	012	014	017	020	025	084
14200	3600	814	005	010	011	012	013	013	016	027	057
14600	4000	815	006	013	013	013	013	014	019	031	071
14200	4400	816	004	012	013	013	013	013	015	022	100
7000	4500	817	007	012	012	012	012	012	012	026	100
7400	4100	818	010	020	020	020	020	020	020	026	060
7800	4500	819	006	019	019	019	019	019	019	021	100
7400	4800	820	007	020	020	020	020	020	020	028	074
3000	1600	821	002	003	005	003	008	010	011	020	062
5000	1200	822	003	005	006	003	010	012	013	017	037
1100	1600	823	006	007	008	010	012	015	017	022	062
5000	2400	824	003	010	012	013	014	015	016	020	040
4400	7300	825	003	003	010	013	013	014	015	020	100
4700	7900	826	017	021	022	022	022	022	022	041	100
5000	7300	827	003	014	016	015	018	019	022	037	060
4700	7600	828	017	020	020	020	020	020	026	042	098
5000	7500	829	015	024	024	024	024	024	028	036	100
5200	7300	830	005	015	017	013	018	018	023	035	096
5700	7500	831	017	022	023	023	023	023	030	050	100
5200	7700	832	005	016	016	016	017	021	025	039	060
1200	4400	833	005	007	010	013	013	013	014	022	100
1500	4200	834	010	014	015	015	020	025	027	034	100
1900	4400	835	005	006	008	010	010	011	012	018	086
1500	4700	836	008	012	013	014	014	015	018	024	100
13400	4700	837	002	023	024	024	024	024	024	045	100
13700	4400	838	012	013	014	014	014	015	019	025	100
14100	4700	839	005	014	019	020	020	020	022	027	088
13700	5000	840	005	008	010	010	012	014	017	028	100
AVERAGE CI AT EACH DEPTH			008	013	015	016	016	017	019	029	083

PENETROMETER DATA

29 APR 69 RANGE 72 LINE NO. 161/162
 DATA COLLECTED FROM 1721 TO 1802 HRS

PENETROMETER WITH 0-100 DIAL GAGE AND 3.22 SQ CM CONE

POSITION IN CENTIMETERS			STATION	CONE	INDEX	READINGS	AT DEPTHS IN CENTIMETERS					
X	Y	NO.		0.0	2.5	5.0	7.5	10.0	12.5	15.5	22.5	30.0
5300	2900	841		007	011	011	011	011	013	016	025	037
5600	2600	842		004	006	008	011	014	017	017	022	036
6200	2900	843		005	012	012	012	012	015	018	023	037
5600	3200	844		003	007	010	011	013	015	017	025	039
4700	4000	845		006	010	013	014	015	017	019	024	052
5000	3600	846		004	011	012	012	013	015	018	027	044
5500	4000	847		010	013	018	019	021	024	030	043	062
5000	4300	848		005	010	012	013	013	018	020	026	039
4600	5000	849		003	010	012	013	016	017	020	024	054
5000	4600	850		002	007	008	010	013	015	017	024	044
5600	5000	851		003	013	014	013	015	015	018	030	054
5000	5300	852		005	010	012	012	012	018	020	028	052
5800	4100	853		003	012	014	015	016	017	020	025	054
6100	3800	854		008	015	015	015	017	019	022	036	054
6600	4100	855		002	006	009	010	012	013	015	020	030
6100	4500	856		006	012	013	013	014	019	021	029	057
9800	6100	857		004	011	011	011	011	011	013	020	038
10300	5700	858		003	006	008	010	011	013	014	019	039
10900	6100	859		006	010	011	011	012	013	015	021	033
10300	6500	860		013	014	015	017	017	017	021	033	035
AVERAGE CI AT EACH DEPTH				005	010	012	013	014	016	019	026	045

PENETROMETER DATA

6 MAY 69 RANGE 72 LINE NO. 161/162
 DATA COLLECTED FROM 1730 TO 1758 HRS

PENETROMETER WITH 0-100 DIAL GAGE AND 3.22 SQ CM CONE

POSITION IN CENTIMETERS			STATION	CONE	INDEX	READINGS	AT DEPTHS IN CENTIMETERS					
X	Y	NO.		0.0	2.5	5.0	7.5	10.0	12.5	15.5	22.5	30.0
2300	3700	861		002	004	006	007	008	010	013	023	038
2500	3400	862		003	007	009	011	013	017	018	027	042
2800	3700	863		002	005	007	009	011	013	017	029	038
2500	4000	864		002	004	005	007	009	012	015	025	034
4200	3600	865		002	007	010	011	014	018	022	076	100
4500	3400	866		001	005	009	011	014	019	022	032	090
4900	3600	867		002	008	013	015	017	023	028	100	100
4500	4000	868		002	005	007	008	009	011	013	021	037
4400	3100	869		001	003	005	006	009	011	013	019	029
4700	2700	870		001	002	004	005	006	008	010	016	023
5000	3100	871		003	006	009	009	011	013	017	024	038
4700	3300	872		002	005	007	010	014	017	022	033	100
4800	1600	873		002	005	008	011	011	013	015	019	026
5100	1200	874		002	003	007	009	011	013	017	024	039
5600	1600	875		001	003	007	010	012	014	014	018	024
5100	1900	876		002	006	007	009	012	013	015	020	028
AVERAGE CI AT EACH DEPTH				002	005	008	009	011	014	017	032	049

PENETROMETER DATA

23 MAY 69 RANGE 72 LINE NO. 161/162
 DATA COLLECTED FROM 1510 TO 1517 HRS

PENETROMETER WITH 0-100 DIAL GAGE AND 3.22 SQ CM CONE

POSITION IN CENTIMETERS			STATION	CONE	INDEX	READINGS	AT DEPTHS IN CENTIMETERS					
X	Y	NO.		0.0	2.5	5.0	7.5	10.0	12.5	15.5	22.5	30.0
9000	10000	877		002	004	006	008	010	012	014	022	100
9300	09600	878		010	010	011	012	014	018	022	030	066
9800	10000	879		004	008	010	011	014	016	018	024	100
9300	10400	880		002	011	012	014	018	022	024	028	062
AVERAGE CI AT EACH DEPTH				005	008	010	011	014	017	020	026	082

UNCLASSIFIED

Security Classification

DOCUMENT CONTROL DATA - R & D

(Security classification of title, body of abstract and indexing annotation must be entered when the overall report is classified)

1. ORIGINATING ACTIVITY (Corporate author) Air Force Armament Laboratory Damage Mechanisms Branch Eglin Air Force Base, Florida 32542		12a. REPORT SECURITY CLASSIFICATION UNCLASSIFIED 12b. GROUP
3. REPORT TITLE CHARACTERIZATION OF THE SAND ON SELECTED MUNITION TEST SITES AT EGLIN AIR FORCE BASE, FLORIDA		
4. DESCRIPTIVE NOTES (Type of report and inclusive dates) Final Report (1 May 68 - 23 May 69)		
5. AUTHOR(S) (First name, middle initial, last name) James C. Richardson		
6. REPORT DATE April 1971	7a. TOTAL NO. OF PAGES 66	7b. NO. OF REFS 2
8a. CONTRACT OR GRANT NO.	9a. ORIGINATOR'S REPORT NUMBER(S) AFATL-TR-71-51	
b. PROJECT NO 9251	9b. OTHER REPORT NO(S) (Any other numbers that may be assigned this report)	
c.		
d.		
10. DISTRIBUTION STATEMENT Distribution limited to U. S. Government agencies only; this report documents environmental conditions under which experimental and/or conventional munitions were tested; distribution limitation applied April 1971. Other requests for this document must be referred to Air Force Armament Laboratory (DLRD), Eglin Air Force Base, Florida 32542.		
11. SUPPLEMENTARY NOTES Available in DDC	12. SPONSORING MILITARY ACTIVITY Air Force Armament Laboratory Air Force Systems Command Eglin Air Force Base, Florida 32542	
13. ABSTRACT Test data was obtained by Environmental Characterization Working Group from two sand test sites to determine how selected environmental factors affect fuze functioning. The sand is described in terms of density, percentage moisture, and penetrometer readings, and each of these was evaluated to determine its variability. Regression analysis tests were performed to determine if a relationship existed between the variables. The variables were first paired by test site and were then combined to learn if one of the variables could be predicted by knowing another. Linear correlation of the variables was also evaluated. The data is based on a controlled environment and the results should not be applied to other environments.		

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14 KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
Sand Characterization						
Effects of Sand on Munitions						
Soil Sample Analysis						
Soil Penetrometer						

UNCLASSIFIED

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